RAILROAD GAZETTE

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CONTENTS.

Contributions.

Tractive Force Formulas.

To the Editor of the Railroad Gazette:

In the discussion of Passenger Train Speeds in your issue of Feb. 16, page 104, there is given one way of deducing the formula $T = \frac{375 \text{ I. H. P.}}{S}$ Another method may be of interest, as it calls attention to some of the first principles on which such formulas are based.

The expression usually given for the cylinder tractive force T is, $T = \frac{d^2 L P}{D}$ (1) in which d is the diameter of the piston in inches, L the piston stroke in feet, P the cylinder mean effective pressure in pounds per square inch, and D the diameter of the drivers in feet.

The tractive force may, however, be expressed in different terms than those given in equation (1). Thus, if A is the area of the piston in square inches L the length of stroke, and P the same as used in equation (1), then will P A L be the ft.-lbs. in one stroke; consequently 4 P A L will equal the work done for each double stroke for two cylinders. The circumference of the drivers is π D, which, multiplied by the tractive force at the rails, must equal the work done in the cylinders, or, 4 P A L = T π D. Therefore

$$T = \frac{4 P A L}{\pi D} \quad \ldots\ldots (2)$$

In the familiar equation for indicated horse-power, (for both ends of both cylinders), I. H. P. $= 4 \frac{P L A N}{33{,}000}$. P, L and A have the same meaning as these letters in equation (1), and N is the number of strokes in a single cylinder. Transposing,

$$P A L = \frac{33{,}000 \text{ I. H. P.}}{4 N} \quad \ldots\ldots (3)$$

Substituting the values of P A L of equation (3) in equation (2),

$$T = \frac{33{,}000 \text{ I. H. P.}}{\pi D N} \quad \ldots\ldots (4)$$

In which π D N = speed in feet per minute. If S = speed in miles per hour and V = speed in feet per minute, V = S × 5,280 ÷ 60, whence

$$\pi D N = \frac{S \times 5{,}280}{60} \quad \ldots\ldots (5)$$

Substituting these values in equation (4) and reducing, we obtain

$$T = \frac{375 \text{ I. H. P.}}{S}$$

W.

The Theory of Velocity Grades.

To the Editor of the Railroad Gazette:

Confession is good for the soul. What Mr. C. C. Wentworth's references to Wellington failed to do, the results of Mr. Herr have accomplished. "Kicker" acknowledges that he has been wrong in maintaining that traction is independent of speed. Will it be allowable, however, to suggest a question as to the propriety of applying Mr. Herr's figures, or Mr. Wentworth's formula for traction to the case of "velocity grades"? Mr. Herr's statement is that "these curves are believed to represent about the maximum horse power the different engines are capable of sustaining continously under service conditions." Isn't it true that an engine, like a horse, can for a short time exert distinctly more than the normal traction? Do not locomotive engineers make preparation for a stiff grade? Don't they well fill their boilers with water and get the water hot in approaching a grade so that no cold water need be introduced for a time? Don't they force their fires and heat their boilers for a brief time, hotter than they will stand for a long period? Don't they in this way secure at the foot of the grade and over the most or all of a short grade, a traction much greater than Mr. Herr's figures show for traction "sustained continuously"? The great gains on velocity grades are made where the grades are short; on long grades the height saved is distributed over a long distance and the gain is less proportionally. If the engineer can thus secure increased traction from his engine at the higher velocities on a velocity grade, then Mr. Wentworth's formulas would require modification in considerable degree. It is even possible (though not probable) that the traction would become nearly constant. The writer would suggest that some additional data definitely bearing on this point would be of considerable value. Will it be out of place for "Kicker" to remark that after having "pitched into" Mr. Wentworth he believes that the latter deserves thanks for being the means of bringing out pretty thoroughly the fact of varying traction, which many civil engineers certainly have not appreciated.

In answer to a private criticism that there is quite a discrepancy between the experiments quoted by "Kicker" and the results of Mr. Herr, it may be stated that the discrepancy is apparent rather than real. Mr. Herr's results were for continuous performance. The result giving a coefficient of traction of about ¼ at about 20 miles per hour was based on a shorter performance and possibly represented only one or two indicator cards where the average of these experiments gave a coefficient of traction of about 1/7. In view of Mr. Herr's results, it would appear that the engine may have been running nearly or fully up to its boiler capacity, although it was not so stated by the author of the paper. The experiments and the results were quoted by "Kicker" in good faith and furnish an example of how easy it is to use facts with perfect honesty to support a position which is really unsound.

"KICKER."

A Pumping Engine Test.

On July 8, 1898, Prof. W. F. M. Goss, of Purdue University, tested a 20,000,000-gallon triple-expansion pumping engine built by the Snow Steam Pump Works, Buffalo, N. Y., for the Indianapolis Water Company, and obtained the remarkable duty of 150.1 million foot-pounds of work per million British thermal units and a steam consumption per horse power per hour of 11.26 lbs. The test was made with the expectation that the engine performance would fall within the range of ordinary results, and when such exceptional results were obtained, it was thought best to verify the work by a test conducted on a broader plan. The second test was made Dec. 3, and the full reports of both have just been published in pamphlet form by the engine builders.

In both runs Mr. E. C. Sornberger represented the engine builders and Mr. John Rail the Indianapolis Water Company. Data in the final test were obtained by 14 different observers, the most of whom were senior engineering students at Purdue, each observer maintaining his station without relief throughout the 12-hour test. It may be said in general that the second test confirmed the previous results, the duty being 147.5 million foot-pounds per million British thermal units and the steam consumption 11.38 lbs. per horse power per hour.

Extracts from Prof. Goss' report of the second test are as follows:

Capacity.—During the 12-hour test, the lowest rate of speed for any 5-minute interval was 19.2 revolutions per minute, the highest was 22.2 revolutions, and the average for the whole 12 hours was 21.2 revolutions per minute. This speed gives the pumps a capacity based on plunger displacement of 20.3 million gallons per 24 hours.

Leakage.—Before and after the test of July 8 very careful tests were made to determine the amount of water leaking past valves and plungers. It was found that leakages from all sources combined amounted to but a few thousandths of one per cent. of the water pumped, justifying the conclusion that for all purposes, either practical or theoretical, the pump is tight. The significance of this statement will be better appreciated when it is considered that the pump contains 540 suction valves and 540 delivery valves, or a total of more than a thousand valves. A defect in a single one of these would have been disclosed by the tests which were made. The facts having been once established, it was thought unnecessary to repeat this phase of the work in December.

Work of the Steam Cylinders.—The indicated horse power for the whole engine under the conditions of the test is 782.9, divided between the several cylinders as follows: High-pressure, 257.6; intermediate, 224.5; low-pressure, 300.8.

Work of the Water Cylinders.—The horse power developed in the water cylinders, as shown by indicators is 736.3, divided very nearly equally between the three pumps.

Steam Used.—The steam delivered to engine throttle contained one per cent. of moisture. The total weight of moist steam used for the test, for all purposes, was 108,011 lbs., or an average of 9,001 lbs. per hour. The actual weights observed per hour disclose a maximum variation from the average rate of a trifle more than 2 per cent., a difference due chiefly to variation in the speed of the engine.

Hydraulic Friction.—The duty performance is based on pressures observed in the suction and force mains at points where these pipes connect with the engine. Duty thus based does not credit the engine with work done in moving the water through the valve chambers and passages connecting them with the pump cylinders. The assumption is that the work done in moving the water through the passages of the pumps is properly charged against the machine as a loss for which the mechanism is responsible.

The total friction may be assumed to be the sum of the machine friction and the hydraulic friction, or 50.3 h. p., which is 6.2 per cent. of the indicated horse power, an extremely low value.

Duty Record Broken.—A comparison of results obtained from the final test with those obtained from the test of July 8, and with similar results reported from tests of other engines, is given in Table I. It should be noted that the duty disclosed by the data under discussion exceeds by a liberal margin that obtained from any pumping engine from which results have ever been published. It justifies the conclusion that no engine exists which has equaled the performance of the engine tested.

From Table I it will be seen that these three engines work in similar service and that they develop nearly the same power. While the Leavitt engine has the advantage of the highest steam pressure (Item 12), the Snow engine works under the greatest number of expansions (Item 13). In cylinder performance the Snow engine excels the Allis, but is slightly inferior to the Leavitt (Item 19), the Snow engine having a handicap in the form of rather large cylinder clearance. The duty performance of the Leavitt engine has been quoted in connection with that of the Snow engine as 141.9, which is the value given by Prof. Miller in his report. But it is stated that the value is based on weir measurements. From data given, the value which appears in the table (Item 20) based on work done by plunger has been deduced. It is entirely comparable with the other value in the same line. A comparative study of the full data derived from tests of the several engines referred to discloses many incidental facts which are of interest. Chief among them is the relatively small percentage of the total steam which is used in the jackets and reheaters of the Snow engine.

In estimating the duty performance of the Snow engine from the values given it should be remembered that the comparison is between the finest and most efficient machines which have yet been produced. It is not that the Snow engine excels another engine, but that it excels, by a liberal margin, the best that has hitherto been produced. The significance of a duty performance of 147.5 millions is further emphasized by comparing it with the possible duty which, under similar conditions of steam pressure, is to be expected from a perfect engine; that is, an engine that is absolutely frictionless and in which the thermal action is ideally perfect. Such an engine, were one possible, would give a duty under the conditions of the test of 194. millions. No actual engine can ever give this duty, but it

TABLE I.—RECORD-BREAKING PUMPING ENGINES.

1. Name of designer or builder	E. P. Allis Co.	E. D. Leavitt, Jr.	Snow Steam Pump Works	
2. Locality	Milwaukee	Chestnut Hill, Mass.	Indianapolis, Ind.	
3. Type	Triple expansion	Triple expansion	Tripple expansion	
4. Extent of jacketing	Barrels and receivers	Barrels, heads and receivers	Barrels, heads and receivers	
5. Name of expert conducting test	Prof. R. C. Carpenter	Prof. E. F. Miller	Prof. W. F. M. Goss	
6. Capacity million gallons in 24 hours	15	20	20	
7. Size of steam cylinders, inches	28, 48, 71 x 60	13.7, 24.37, 39 x 72	29, 52, 80 x 60	
8. Size of water plungers, inches	32 x 60	Double acting 17.5 x 48	33 x 60	
9. Date of test	1893	1895	July 8, 1898	Dec. 3, 1898
10. Total head, lbs.	70.4	59.4	88.7	89.2
11. Piston speed, feet per minute	203.1	607.0	214.6	211.8
12. Pressure near throttle (above atmosphere) lbs.	121.4	175.7	155.6	154.6
13. Rate of expansion	20.4	21.0	23.8	22.4
14. Indicated horse-power	573.9	575.7	*775.5	782.9
15. Friction, per cent.	9.2	10.5	*4.6	6.2
16. Dry steam per I. H. P. per hour including jacket and reheater steam, lbs.	11.68	11.22	*11.26	11.38
17. Per cent. of steam condensed in jackets and reheaters	9.2	17.1	.....	6.2
18. Dry steam per I. H. P. per hour exclusive of steam used in jackets and reheaters, lbs.	10.61	9.3	.....	11.67
19. B. T. U. per I. H. P. per minute	217.6	204.3	*209.7	209.9
20. Duty based on 1,000,000 heat units, expressed in million foot-pounds	137.7	†144.5	150.1	147.5

* Values not considered as entirely reliable.
† Recalculated from data published by Professor Miller.

is interesting to note how closely the performance of the Snow engine approaches that of the ideal. Future improvement can only serve to reduce the margin of 46 million which separates between the performance of the Snow engine and that of the ideal.

Conclusions Concerning Results of Final Test.—The record of the final test as disclosed in the preceding paragraphs may be accepted as a safe and conservative measure of the capabilities of the engine. It shows that the machine may be employed with certainty for continuous running at its rated power, and that when the steam pressure was 1 lb. lower, and the speed 0.3 of a revolution lower, the pressure against which pumps were operated was slightly higher, but the work done by the pumps per unit of time was lower by about three-fourths of one per cent. All differences are slight and could have but little effect upon the performance of the machine.

The following table presents a summary of engine dimensions and of the facts derived from the test:

Dimensions.	
Diameter of cylinder—inches.	
High pressure	29
Intermediate pressure	52
Low pressure	80
Clearance—per cent. of piston displacement.	
High pressure	1.7
Intermediate pressure	2.2
Low pressure	2.5
Diameter of pump plungers, three single-acting—inches	33.
Stroke of all pistons and plungers—inches	60.
General Data for Test.	
Duration of test—hours	12.
Total revolution of engine	15,250
Total plunger strokes	45,750
Revolutions per minute	21.18
Steam pressure in supply pipe near engine, by gage—pounds	154.61
Barometric pressure—pounds	14.31
Temperature of water pumped—deg. F.	58.8
Total weight of moist steam used by engine—pounds	108,011.
Percentage of moisture in steam	1.0
Total weight of dry steam used by engine—pounds	106,931.
Pump Data—Data Shown by Gage.	
Water pressure against which pumps delivered—pounds	81.5
Vacuum in suction against which pumps drew—pounds	2.8
Pressure equivalent to vertical distance between gages—pounds	4.9
Total pressure against which pumps were operated—pounds	89.2
Foot-pounds of work delivered by pumps	17,452,000,000
Total horse-power delivered by pumps	734.5
Pump Data—Work Shown by Indicators.	
Horse-power used by pumps.	
High	246.5
Intermediate	243.8
Low	246.0
Total	736.3
Indicated horse-power.	
High-pressure cylinder, head end	134.9
High-pressure cylinder, crank end	122.7
Intermediate-pressure cylinder, head end	114.9
Intermediate-pressure cylinder, crank end	109.6
Low-pressure cylinder, head end	147.7
Low-pressure cylinder, crank end	153.1
Total	782.9
Heat Consumption—B. T. U.	
Total heat in one pound of steam having a gage pressure of 154.6 and containing 1.0 per cent water.	1,185.3
Heat in one pound of water at the temperature of discharge from engine cylinders, 111.9 deg. F.	79.9
Heat in one pound of water at the temperature of discharge from high-pressure jacket, 354 degr. F.	325.9
Heat in one pound of water at the temperature of discharge from intermediate jacket, 205.0 deg. F.	173.7
Heat in one pound of water at the temperature of discharge from low-pressure jacket, 209.3 deg. F.	178.1
Heat in one pound of water at the temperature of discharge from receiver-reheater coils, 253.2 deg. F.	222.3
Heat consumed in cylinders	111,957,000.
Heat consumed in high-pressure jackets.	1,879,000.
Heat consumed in intermediate-pressure jackets	1,756,000.
Heat consumed in low-pressure jackets.	1,170,000.
Heat consumed in receiver-reheater coils	1,584,000.
Total heat used by engine during test, B. T. U.	118,346,000.
Significant Results.	
B. T. U. per indicated horse-power per minute	209.9
Dry steam per indicated horse-power per hour	11.38
Machine friction in engine and pumps—per cent. of I. H. P.	6.0
Hydraulic friction in passage of water through valves and passage—per cent. of I. H. P.	0.2
Total machine and hydraulic friction—per cent. of I. H. P.	6.2
Duty on basis of thousand pounds of dry steam as defined by contract	163.2 x 1,000,000.
Duty on basis of a million B. T. U.	147.5 x 1,000,000.
Capacity in gallons per 24 hours	20.3 x 1,000,000.

Electro-Pneumatic Interlocking at the Boston Southern Station.

By J. P. Coleman.

[WITH AN INSET.]

(*Concluded from page 87.*)

The Interlocking Machine.

By reference to the figures A, B, C, D, E and F of the previous article, and by a study of drawings 4, 5 and 6 accompanying this one, the functions and general construction of an electro-pneumatic machine will be made apparent. The general appearance of the 143 lever machine in use in Tower No. 1, at the Boston Southern station, was shown in the Railroad Gazette of July 21, 1899. Bird's eye views of parts of a somewhat smaller apparatus are shown in Figs. X and Y, on the inset in this issue, while sectional views through it at points indicated thereon are represented in Figs. 5 and 6. The only structural differences between this machine and the large one of Tower No. 1 are the greater width of the mechanical locking bed and the greater number of levers the latter contains, and as these are not material to a comprehensive discription of either, the smaller one, being somewhat simpler, is the one selected for chief illustration.

Track Model.

From the larger machine, however, a better idea of the lever and "track model" arrangement is obtained. The track model, as is indicated by its name, is a miniature of all tracks signaled and all switches operated from the machine—the latter shifting with the levers (by purely mechanical connections) to correspond with those on the ground, and hence giving to the operators constant evidence of the track connections formed by them. The front of the track model is shown in the view of the machine published with the article of July 21, and also in the view of the tower shown with the same article. The back of the model was shown in that article, and a part of it appears in Fig. X, shown on the inset herewith.

All signals operated are also shown on the model in proper relation to the tracks governed by them, and these and the switches are marked each with the number of the lever operating them, so that this model virtually becomes a guide to the leverman, from which he can check his work at will, and it also forms a most efficient tutor to those learning the manipulation of the machine—saving all necessity of the manipulation charts customarily employed for this purpose, and proving infinitely more useful than these in securing prompt efficiency in new men. While the necessity of the model is not always conspicuous, and while on small machines it may even be of doubtful value, the advantages obtained from its use in large machines cannot be disputed if for no other reasons than those given. It is peculiar to the electro-pneumatic machine, however, only because custom has associated the two, and since its manifestly possible application to other types has not yet been attempted.

Lever Arrangement.

The levers of this apparatus are diminutive in size (see Fig. 4), and are different in design from those of mechanical machines, as was previously stated. They more closely resemble the construction of an ordinary hand crank than the form of lever peculiar to other machines. The reason for this is found in the arrangement of the machine proper, which consists of a series of parallel shafts (one for each lever) arranged horizontally in much the same manner as are those operated from the catch rods of mechanical machines for shifting their locking. These shafts are adapted to be turned through an arc of 60 degrees by the levers when the latter are fully operated, and are suitably connected to the bars of the locking to produce the longitudinal motion in them that is essential to the shifting of the "cross-locks" by which one bar is made to interlock with another in the manner customary in other types of interlocking apparatus. The "driver" in this machine consists of a segment of a pinion secured to the shaft, which meshes in the teeth of a rack cut in the under side of the bar above it. In other respects the locking and its support differ from those of other machines only in their relatively smaller proportions. Beyond this locking the shafts extend over a hard rubber plate upon which are arranged a number of thin strips of phosphor-bronze that extend under (or up to) corresponding strips, partially surrounding hard rubber tubes secured to and surounding the shafts (Fig. X). These strips are joined in common to a battery (usually six cells of storage type), located in the tower, and they form parts of the circuits by which the switch and signal valve magnets are energized. When it is desired to control any one or more of these devices by any one or more levers in the machine their strips are interrupted under and bent upward to rest against opposite sides of the rollers of such levers, and the bands upon the rollers are so set with relation to the lever's position that these circuits may be closed or opened by any lever in any position of it that circumstances demand. These bands and strips correspond in functions to those of the circuit shifters of the levers shown in Figs. A, B, C, D, E and F, and the arrangement possesses capacity for unlimited combinations of control. If it were desired, much of the interlocking between levers, or between the switches and signals, could be here accomplished by aid of the electric locks which engage extensions of the shafts and which are located under these just beyond the rubber plate and rollers. Where locking between two machines in separate towers is to be performed, this is frequently made use of.

Each shaft is provided with one of these locks, and each switch lever shaft with two, for purposes corresponding to those of the locks of Figs. A, B, C, D, E and F. These locks engage the shafts through the medium of "sectors," secured to the shafts, that project downward into the paths of pawls carried by the armatures of the magnets. These sectors appear at the right in Fig. X.

The sectors are so constructed that signal shafts are moveable 30 degrees in one direction or 30 degrees in the other—the effect of each such movement being to close, by means of the strips and bands described, a circuit on one or the other of two or more signals conflicting in function, and which in turn control the lock. A signal moved to safety by this turning of the shaft, in either direction, causes the lock to engage the sector and to prevent its full return to the central position until the signal once more assumes danger—which it does in response to a partial rotation of the shaft toward its normal (central) position.

It will be seen that this shaft performs all the duties assigned to the lever of Figs. A, B. and C in moving the signals of that arrangement, and that it is in like manner controlled by the signals it operates.

Without following the detailed operation of a switch lever shaft of the pneumatic machine through its motions in operating a switch, it is sufficient to state, for an understanding of this, that its complete rotation through 60 degrees is prevented by one or the other of the two magnets engaging it, just as the full movement of the lever of Figs. D, E and F is prevented by one or the other of the magnets (N and R) engaging it, until the switch has moved and locked in response to the partial lever movement. The partial rotation of the switch lever shaft causes (by means of the bands upon its roller) the same change in the switch valve circuit as did the partial shifting of the mechanical lever referred to, and hence a corresponding reversal of the switch. The locks are controlled by the same switch movement contacts also, and perform in all respects like functions to those of the mechanical lever.

A section of the rubber tubing surrounding each switch lever shaft is arranged loosely upon the shaft, so that the latter may be turned therein without shifting the section so mounted, during the *preliminary* movement of the shaft; but after the switch has moved, and the shaft has been in consequence released, the final movement of the shaft rotates the loosely mounted roller with it through an arc of about 10 degrees.

Upon this roller are arranged two pairs of contacts that are alternately opened in one position of the roller and closed in the other, and which form parts of the circuits controlling the switch lever locks (the "indication magnets").

These circuits are controlled by this device in exactly the same manner as are those of magnets N and R of Figs. D, E and F, and the whole device performs the functions illustrated by the circuit shifter under the tappet of the lever shown in the figures mentioned. In the pneumatic machine, this roller is held from shifting (by vibrations or by accidents) to open the circuits on both magnets during lever operations by means of a toggle joint under the influence of a coil spring, as is apparent from the drawings and general views of the machine, and marked a "quick switch" on the former.

The levers of the machine are attached directly to the shafts described, and are constructed alike in all respects, but differ in arrangement. Those which operate signals occupy a vertical position normally and extend downward from the shafts, while the switch levers stand normally 30 degrees to the left of the vertical and extend upward from the shafts.

Switch and signal levers are usually arranged alternately in the machine, but may be otherwise arranged if desired, and are placed but 2½ inches apart—half the distance between the levers of mechanical machines.

The "catch rod," so conspicuous on mechanical levers, is here scarcely visible, as it is mounted in the rear of the lever's body and controlled by a spring entirely concealed from view. (See Figs. 5 and 6.) It is operated either by a slight rotary movement of the lever handle or by a direct upward movement of it, and engages a small quadrant secured to the machine frame behind the lever, that corresponds in construction and purpose to the usual quadrant of the mechanical levers of Figs. A, B and C.

Alternate switch levers differ in lengths to secure freedom from interferences of handles in operation, where one lever is normal and the adjacent one is reversed, and hence in close proximity to the former.

In the description of the electric locking provided for insuring the return of signals to danger before the complete return of their levers to normal can occur, it was for simplicity's sake assumed that the circuits controlling these locks (Figs. A, B and C), were normally closed—closed when the signals were at danger and the levers were in their central positions. While this is true so far as the actual requirements of this precautionary device is concerned, it is nevertheless not true in actual practice, and these locks remain upon open circuits when the above condition exists, by reason of contacts arranged in their circuits that are opened by motion of the lever catch rods when these are "latched" in their normal position. Each signal-lever lock circuit is thus opened by the lever it controls after it has performed the duty intended of it, and remains so until the latch is again raised previous to an attempt to again move the lever. This arrangement is introduced solely to economize in the electric current employed, and reduces the amount to practically nothing, as is apparent from this and from the fact previously stated, that the lock remains on an open circuit also during the time the lever is reversed and the signal is at safety.

When more than one switch is operated from a

pneumatic lever, as in the case of crossovers, the valve magnets and indication contacts of the two or more movements required for this are arranged in series, as shown in Fig. G (previous article), the valves shifting simultaneously as a result.

Each of the two contacts that are, under those conditions, included in the indication circuit, closes as each switch becomes fully moved and locked, this being the case, whether these operations occur simultaneously or otherwise.

The New Locomotives on the Southern Railroad of France.

During the past 10 years the average running speed of the express trains on the Southern Railroad of France has been gradually increased until now it is about 30 per cent. more than it was in 1890. The schedule speed of the fastest trains is about 37 miles an hour, which makes it necessary to run at times from 50 to 55 miles an hour. On this road the many sharp curves and heavy grades call for engines of a large tractive power. To do the heavier work required by increased speeds and heavier trains, some new four-cylinder compound locomotives have been built, the particulars regarding which we take from Engineering (London).

The engines of one of the new types are four-coupled and of the other six-coupled. We may first note some facts about the four-coupled engines.

The driving wheels are 84½ in. in diameter. The front end of the locomotive is carried on a truck, with four wheels 3 ft. 4¾ in. in diameter. The rigid wheel base of the engines is 9 ft. 9 in. and the total wheel base 24 ft. 7 in. The engine is 34 ft. long over all and 9 ft. 11 in. wide. The high pressure cylinders are put outside the frames and drive the rear wheels, while the low pressure cylinders are inside and drive the front wheels. The diameter of the former is 13.78 in. and the latter 21.61 in., with a stroke of 25.2 in. The boiler is of steel, with plates ⅝ in. thick and made for a working pressure of 199 lbs. per sq. in. A copper firebox and a superheater are used. The heating surface of the interior of the tubes is 1,868 sq. ft., the firebox surface is 161.2 sq. ft. and the grate area 26.15 sq. ft. There are 11 tubes with an internal diameter of $2\frac{3}{16}$ in. The weight of this locomotive in working order is 54 long tons, of which 16.4 tons are on each driving axle and 21.2 on the truck. The tender is carried on six wheels and the tank has a capacity of 3,300 gallons and space for four tons of coal.

The other type of engine which has been adopted has many things in common with the four-coupled locomotive just referred to. They have six-coupled wheels, either 5 ft. 9 in. or 5 ft. 3 in. in diameter, depending on the work for which they are to be used. The weight available for adhesion is 2,000 lbs. greater in these than in the four-coupled engines, this increase being required on account of the steeper grades over which they run. Their working steam pressure is 213 lbs. per sq. in. The rigid wheel base is 12 ft. 9½ in. and the wheel base of the front truck 6 ft. 6¾ in., with a total wheel base of 25 ft. 3 in. The weight of the engine empty is 51.3 tons, and in running order 56½ tons, of which 40.7 tons is on the driving wheels and 15.8 on the truck. The high pressure cylinders are put outside the frame, between the rear axle of the truck and the forward driving axle. The diameter of the high pressure cylinders of these locomotives is 13.78 in. and of the low pressure 25.59 in., and the stroke is 25.2 in. The ratio of the volume between the two cylinders is 2.469. The intermediate reservoir has a capacity of 7.95 cubic ft. and is put under the smokebox, between the two low pressure cylinders.

This locomotive has a four-wheel tender weighing 12.1 tons empty, or 24.4 tons in running order. Its capacity for coal and water is sufficient for the longest runs on the road without stopping. The total heating surface is 1,213½ sq. ft., and the weight empty is 54½ tons and 60 tons in running order.

A Prussian Railroad School.

Jan. 1 last the Berlin directory of the Prussian State Railroads opened a "railroad school" for the instruction of candidates and men in training for appointments in the regular permanent railroad service in the operating department, as a supplement to their practical training. The instruction is given at one of the Berlin stations on three days of each week between 8 and 10 a. m., and the course is for one year. The instruction is made part of the duty of the candidates and is thus obligatory on them all. Instruction is given on 27 different subjects, and there is a separate instructor for each subject. For instance, a road-master gives instruction concerning superstructure, switches, turn tables, signals and rolling stock. Particular attention is given to railroad accounts, as the greater number of the students are candidates for the grade of "railroad clerk," and generally it is intended to school the men so they may intelligently perform their peculiar duties according to the rules and regulations in force.

All the student-candidates have already had a certain prescribed education, and many of them are graduates of technical schools. These latter, however, are not required to follow all the studies of the new railroad school. The instructors are mostly employes of the lower grades, particularly "railroad clerks," who thus teach the methods of doing the very work in which they are daily engaged.

A Link for Couplers Without Slots.

The day is near when there will be practically no more link and pin couplers running in main line service. Of course, technically the compulsory equipment with automatic couplers is merely for stock running in interstate service, but obviously that covers pretty much all the freight cars of the United States. That being so, there will be a steady movement to do away with the slot in the knuckle and

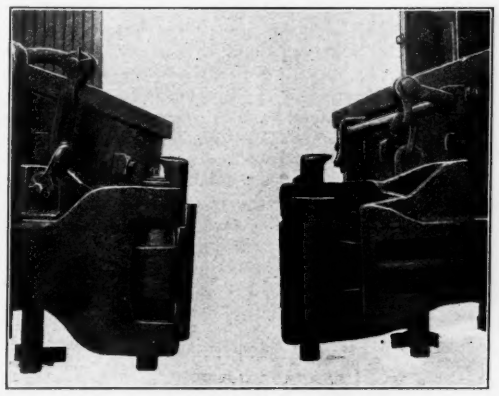


Fig. 1.

some arrangement will be used for coupling cars where the M. C. B. couplers cannot engage. For instance, there are sidings leading into industrial works on which the curvature is so sharp that it is necessary to interpose a link or a coupling bar between two M. C. B. couplers.

The McConway & Torley Company has designed an arrangement to meet such conditions, which they believe will make it entirely practicable to do away with the link slot. This is illustrated by the two engravings herewith, made from photographs.

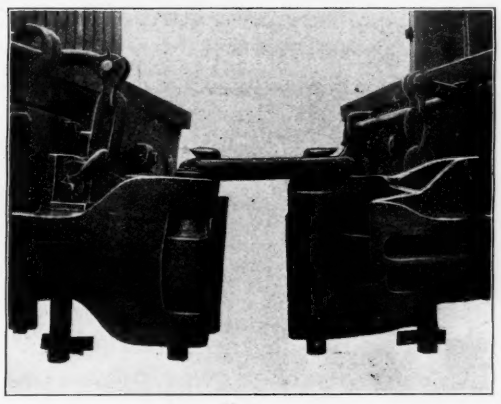


Fig. 2.

In Fig. 1 may be seen two M. C. B. couplers with solid knuckles and on the top of each knuckle there is a stud projecting high enough to receive an ordinary link or coupling bar. Fig. 2 shows two cars connected in that way. If greater flexibility is wanted one of the knuckles may be left unlocked, or indeed both of them. It does not seem necessary to make any further description of a device so simple.

Electrical Engineering on the Brooklyn Heights Railroad.

The building of the electric roads from Brooklyn to the summer resorts on the extreme southern end of Long Island, and the work of electrifying the Brooklyn elevated railroads, which is now under way, have presented some peculiarly interesting problems, and in their solution much sound engineering judgment has been used. Especially trying are some of the conditions in the building of these "excursion" lines, for the period of maximum travel is limited to a few weeks and sometimes to a few days. At the meeting of the New York Railroad Club on Thursday evening of last week, Mr. R. L. Russell, Assistant Engineer of the Brooklyn Heights Railroad, discussed some of these problems. Two roads in particular were considered—the Bergen Beach Railway and the Sea Beach line, both of which are controlled by the Brooklyn Heights Railroad.

Bergen Beach Line.—The extreme ends of the feeders on this line are 8.8 miles from the nearest power station. The equipment was provided on a 30-car basis, no special methods being adopted. This would demand an average maximum current of not over 600 amperes (or 400 h. p.). The electrical pressure might drop as low as 400 volts.

This line was opened on Decoration Day, 1896, and the facilities provided could not even begin to meet the heavy traffic. The extra load was taken care of in the following way: One of the generators of the 52nd Street station was provided with sufficient resistances in the shunt field to bring the voltage down to 125 volts, and it could be raised, if desired, to 600 volts. When the load increased beyond the 600 amperes (or 400 h. p.), for which the line was designed, this generator was connected in series with the feeders and the station bus, thus raising the electrical pressure at the station to a sufficient amount to take up the increased line loss. There were three wires on the line; two were fed through the temporary booster, while the third remained connected with the main station feeder bus. This was so that the reading on its ammeter would show whether the pressure on the line exceeded that at the power house, and therefore determine if the line pressure was dangerous to motors and lamp circuits. After a little experimenting, it was found that this rough method gave very satisfactory results and it was possible to keep the electrical pressure at any desired amount, regardless of the number of cars running on the line; in fact, a large number of cars was a safeguard against getting the voltage too high. The points to be emphasized are these: The wires were made to carry three times the designed amount of electrical current by taking up the losses, thereby increasing the pressure, and this rise in pressure was obtained without special machinery, and carried much higher than ever before attempted in electrical railroad practice.

Sea Beach Line.—In distributing the load on this line a radical departure was made from established methods of figuring the necessary copper for feeders. The carrying capacity was the only thing considered in the arrangement. It was estimated that 1,900 amperes (or 1,275 h. p.) would be very near the average maximum on the line, and, as a matter of fact, readings showed that on the day of heaviest travel the greatest load during the maximum hour was 2,060 amperes for 1,380 h. p., about 8 per cent. increase over the original estimate. The feeder problem was the first to be met and solved. To keep the uniform voltage, so that a high speed schedule could be maintained, two boosters designed especially for the work were direct connected to comparatively inexpensive engines. These boosters were so designed that any desired increase of pressure from 25 to 400 volts above that of the power station could be secured. They were so wound that they would be in a measure self-regulating, but contained also shunt field coils, which could be easily adjusted to take up the fixed current of the system, and divide proportionately the load between the two machines and the feeders, which were direct-connected on the station bus. The beginning of the line was a little over three-quarters of a mile from the station, and so a certain portion of the road could be easily operated without raising the voltage. Each of the two boosters were "cut in" at two points and these four wires and the direct-feed wire were connected by an equalizing wire. That is, the feed for this section of 12 miles of trolley wire was supplied from the station bus at 580 volts, and from two independent boosters of different voltage. This line, running in multiple, operate with entire satisfaction, the average voltage of the line during its heaviest hours running from 486 to 510 volts.

Another difficult problem has been in connection with the running of the heavy electric elevated trains over former steam roads, such as on the Brighton Beach line. These trains will take from 700 to 800 amperes when starting and an average load of 400 amperes for four-car trains, when making an average schedule of 28 miles an hour. This low schedule speed is accounted for by the fact that connections to the steam road make it possible to run surface cars over a part of the line. It will thus be seen that the stoppage for any reason of one elevated train makes a considerable difference in the load carried on one section and consequently greatly affects the local voltage. Specially designed boosters could, however, keep these fluctuations well under control, providing wires were carried to enough points on the line, so that a change of load would not greatly affect the pressure over any considerable portion of the line; but if one of the trains stopped and then immediately started again, the current used would run up to 800 amperes and drop immediately to zero. If there were no trolley cars interspersed between the elevated trains and the current for lighting the cars of the elevated road were supplied from some source other than that used for the trolley cars, a sudden rise in voltage would do no harm whatever, for the motors would be taking current until the controller was thrown off, and so the voltage would not rise abruptly until the current circuit was opened; consequently, no damage could be done. Under existing conditions, however, these varying loads cannot be handled without expensive machinery and the erection of a larger amount of copper than would pay for excursion lines.

One end of this line connects with the elevated railroad at a point where it is advantageous to put in a storage battery to take up the fluctuations on the road during the winter months. At a point about

6,000 ft. from the Brighton Beach terminal of the line there are certain car sheds not in use, but containing tracks. It is proposed to mount a storage battery on some old freight cars in these sheds and when not needed there, remove a part of the acid from the cells, transport the battery equipment from these sheds to the yards of the elevated railroad for use during the winter months when the load on the elevated is considerably heavier than it is during the summer. Of course, boosters will have to be used in conjunction with these batteries, but no special machinery will be bought. As will be at once noted, the aim will be to use as small an amount of copper as possible and to have the least fluctuations in the load. The generators at 52nd St. will be used (as on the Bergen Beach line) as boosters. This novel method of installing a storage battery plant will appeal to everyone as an ingenious and effective solution of the unusual traffic conditions obtaining in the Brooklyn Rapid Transit Company's System.

Notes on the Manila Railway.

The fertility of the Philippine Islands would appear to present an inviting field for railroad development, though thus far there is but a single line in the Islands, the 128-mile narrow-gage road from Manila northward to Dagupan, an important port on the western coast of Luzon. In view of the evidences to be everywhere seen of the corruption and inefficiency of the Spanish Government in the Philippines it is something of a wonder how it ever came about that the concession for this railroad was granted. Probably there was the expectation of a large revenue from the taxation of the traffic.

The Spanish Government began to think of railroads in its colonies in 1875; and in 1885 a subsidy of $7,650 a mile was offered for a line to Dagupan; but the inducement was not sufficient and subsequently the Government offered to guarantee 8 per cent. annually on a capital of about $50,000 a mile. This was accepted by a firm of London contractors in 1886 and the line was completed in 1892. The name of the road is the Manila Railway. According to the concession the whole property at the end of 99 years was to revert to the Spanish Government.

The country traversed by this line is level, but there are many water courses and for a considerable portion of the distance the roadbed has to be elevated about 5 ft. above the normal surface of the ground. The roadbed is ballasted with fine gravel and presents a good appearance. The ties are hard wood, from trees found near the line. The gage of the track is 3 ft. 6 in. and the rails weigh 45 lbs. per yard. There are at least 60 iron bridges, all of the spans being of the uniform length of 20 meters (66 ft.). The longest bridge is one of six spans.

Though the track and roadbed are substantial the cars and engines are light, most of the latter being of less than 10 tons weight. There are about 20 engines altogether, those which were damaged in the war having been repaired by our military forces. The engine house and machine shops are at Caloocan, three miles from Manila. The passenger cars are of English style and of three classes, the third class having no seats. Of the 100 freight cars owned by the road a good many were destroyed by the operations of the armies. The American commanders have no difficulty in finding men in the ranks of the soldiers to fill all positions in running the road.

Before the war, under the English management, all the train men and station men and other subordinate officers and employees were natives, who were paid from $15 to $40 (Mexican money) monthly. The English officers say that these natives, when properly trained, gave satisfactory service.

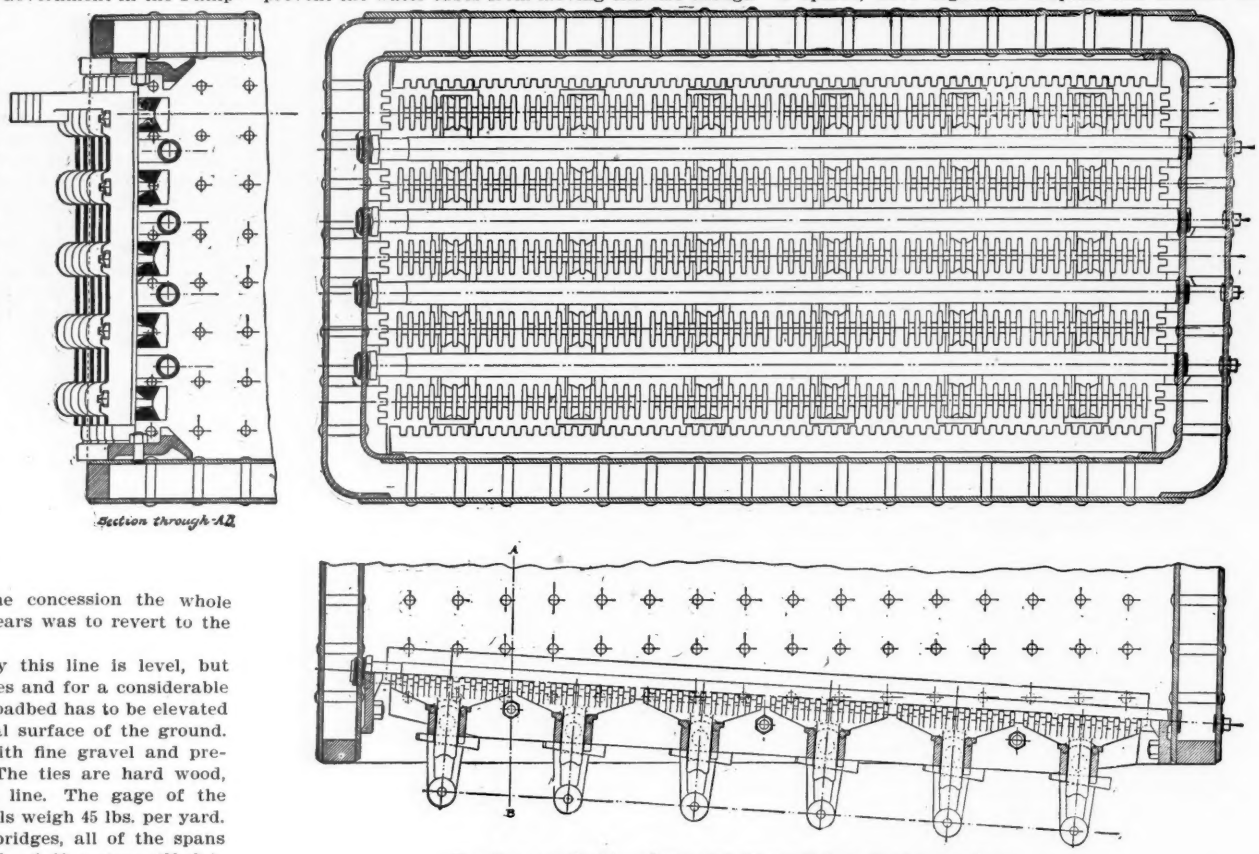
The buildings along the line are excellent. The 28 stations are of uniform type, and differ but little in size. The smallest size is about 30 ft. long. The station at Manila is a wooden structure two stories high, 70 ft. x 45 ft., and the train shed is 325 ft. long. The machine shops were not much damaged by the attacks of the natives.

A trip over this road reveals many interesting scenes. For the first 15 miles out of Manila the surface is irregular and there are constant signs of life, but as we get farther away the population is more sparse and the characteristic landscape is a wide, level valley, surrounded by tangled jungles teeming with myriads of diversified specimens of tropical vegetation. The frequent villages are aggregations of thatched bamboo houses surrounded by fertile fields of rice, hemp and sugar cane. The first important station is Malolos; nine miles farther is Calumpit and the next place of consequence is San Fernando, which has 80,000 population and a number of large hemp mills and sugar refineries. Twenty miles from here the line enters a dense jungle and soon emerges into cocoanut groves. At Tarlac considerable business is done, and at Bayambang there is a large rice mill, owned by Englishmen.

Luzon has vast resources and the fertility of the soil is unsurpassed. The Englishmen who built the railroad testify to the healthfulness of the climate, and this is confirmed by the health of the soldiers now serving in our army on the island.

The Hancock Shaking Grate.

The Hancock shaking grate with water tubes, for locomotives, is shown in plan and elevation in the accompanying illustration. The water tubes screw into the tube sheet of the firebox and the rear ends of the tubes are held fast by sleeves made of composition metal, which are tapered and threaded on the outside and bored on the inside to fit over the ends of the water tubes, which are also tapered for a short distance from the ends. The sleeves being screwed tightly into the back sheet of the firebox, press against the water tubes sufficiently to insure a tight joint. This construction, however, does not prevent the water tubes from moving endwise enough to overcome the inequalities of length due to expansion. Steam is produced economically with either anthracite or bituminous coal when burned in these grates. They are especially adapted for burning coke. The shakers or "choppers" (which oscillate between the water tubes) have 54 per cent. air space.



The Hancock Shaking Grate with Water Tubes—for Locomotives.

These grates, which are made by the Hancock Inspirator Co., Boston, have been in service on a number of the large New England railroads, among them being the Boston & Albany, which reports that they are giving entire satisfaction.

The company also makes a stationary type of shaking grate with water tubes which is, in the main, similar to the type just described. The water tubes, headers and rocker bars of the stationary grates are supported on an independent frame (adjustable in height) which extends entirely around the firebox and is supported on four legs resting on the bottom of the ash pit.

Railroad Relief Associations and the Relations of Railroads to Their Employes.*

By W. H. Baldwin, Jr., President of the Long Island Railroad.

Mr. Baldwin did not attempt a complete analysis and description of relief associations, referring his hearers who desired details to the Commissioner of Labor at Washington, who has published a volume on the subject.

Railroad transportation is a government function and therefore the management of a railroad, including its dealings with employes, is of vital interest to the public. The need of insurance and relief funds was first felt by the employes themselves and the problem was first solved by them. The insurance associations formed by employes without the aid of their employers, some of which were started about 35 years ago, appreciably raised the standard of railroad employes.

There are two forms of Associations: one of all the employes on a given road and the other exemplified in the brotherhood organizations, embracing a certain class of employes regardless of territorial lines. There are four of this latter class, maintained, respectively, by the locomotive engineers, the conductors, the firemen and the trainmen (brakemen). As a rule, these insurance departments have been wisely managed. The principle is practically the same in all of them. A conductor, for example, may insure for from $1,000 to $5,000; assessments limited to $16 per year per $1,000; actual average, about $14. Temporary relief for sickness or accidental disability is left almost entirely to the local divisions, and there are ladies' auxiliaries, so that worthy cases of distress do not lack proper care and assistance.

The first relief asociation fostered by a railroad company was that of the Baltimore & Ohio, started in May, 1880. The Pennsylvania organization was started Feb. 15, 1886, and the Burlington March 15, 1889. To-day 15 per cent. of the railroad mileage of the country has relief associations. Many railroads, especially in the West, where the population is sparse, have organized hospital and medical departments. Some of these are maintained wholly by the railroads, and others by assessments on the men. Of railroad relief associations some are compulsory and others voluntary; generally, the cost is borne partly by the company and partly by the men.

Mr. Baldwin then went on to describe the Pennsylvania Association, as being the most highly developed. With this our readers are already tolerably familiar.

The speaker made a brief comparison of the railroad and the brotherhood associations. The cost of insurance is approximately the same in both. The cost of relief cannot be compared, as the brotherhoods leave that to local bodies. An important element in the railroad associations is that the company generally pays all the expenses of management. Practically, also, the company gives the guarantee of its great capital against risks and losses from temporary causes; this feature is of great importance to the employes.

From this point Mr. Baldwin went on to discuss the general relations of railroads to their employes as affected by questions of wages and conditions of work. If the Government is to control rates it should also protect the corporations in the matter of wages. There must be a limit to the demand of public sentiment for high wages and low transportation rates. Most of the brotherhoods are organized chiefly or largely for "protection," which, being interpreted, means to get wages increased where they are deemed too low. There are three ways for the railroads to meet this question:

First: To avoid any question by paying a "standard" wage, under "standard" rules, and by admin-

*Abstract of an address delivered before the American Economic Association at Ithaca, N. Y., December, 1899.

istering the property in such manner as to render unnecessary any appeal from organized labor, or, if such appeal be made, to refuse to consider it.

Second: If unable from financial or other reasons to grant requests for increased wages, to confer with the representatives of the empolyes, whether selected by a labor organization or not, and to explain fairly to the class of labor involved the reasons for declining the request, thus recognizing organized labor.

Third, To decline to meet the official representatives of the class of labor desiring to be heard and to treat the subject as a private matter without regard to the standard of wages paid.

The last method is seldom adopted except by small roads. In dealing with the railroad labor question, the large railway system should be the subject for discussion.

To maintain the first method of meeting the wage question, the great railroad systems of the present day, in performing their government functions, must so administer their property that the wages paid will be the standard railroad wage, the standard wage being the average wage paid by lines similarly situated with similar traffic conditions. There is no standard wage for any class of railroad labor for the whole country. Any attempt to make a standard wage would prove futile. The difference in opportunity for steady work, the comfort of surroundings, the cost of living, the advantages offered by schools, churches, etc., in short, the conditions controlling demand and supply, would make any absolute standard of wage unfair to some roads. The rail roads which treat labor questions under the first class may be said to recognize the responsibility to the public to furnish the best class of men at fair wages and to treat fairly and even generously with their employes direct. The labor organizations give indirect "protection" only to their members on railroads acting under this method.

Second Class.—A large number of railroads, by reason of adverse traffic conditions, financial conditions, etc., are unable to pay even the standard wages in their section of the country. Generally speaking, such roads make a fair statement to the employes or to their representatives, and with a fair spirit on both sides, a reasonable conclusion may be reached. The important element in this method of meeting the question is publicity. A statement to the employes and the public, explaining fully the wages actually earned by the employes who make the request; analyses showing cost of living, compared with other sections commanding higher wages; comparison of wages earned by railroad employes with the wages earned in other service (comparable with it) in the same locality; in short, a straightforward statement of the case is made with the expectation of meeting an honest response from the employes and from the public. This method puts the case squarely before the public as a jury, and the opinion of the public is oftentimes the controlling factor. This method may prove to be of the utmost importance in the future. The extreme prosperity of this country has permitted the railroads to pay the highest wages known in railroad service. With constantly decreasing rates, forced upon the railroads by unbridled competition, the general problem of railroad wages may present itself. The operations of the enormous railroad systems of the future cannot be stopped by reason of wage discussion. In the last analysis the wage question must go to the public as the jury. Entire publicity alone can give the proper foundation for the settlement of any serious question affecting labor in public service—publicity of the facts, regardless of the questions of recognition or non-recognition of labor unions. The same spirit which now demands reasonable direction and control of industrial pursuits will demand reasonable protection of the public, as well as of the employes, in any wage question in public or quasi-public service. The service of the railroad employe will be recognized more and more as the public service.

The relations between railroads and their employes are probably now better than ever before, and never before did the railroads have such a high class of men in their service. Questions at issue are well understood and they should be solved without causing open friction. A company maintaining a relief department gives tangible evidence of a commendable interest in the welfare of its employes.

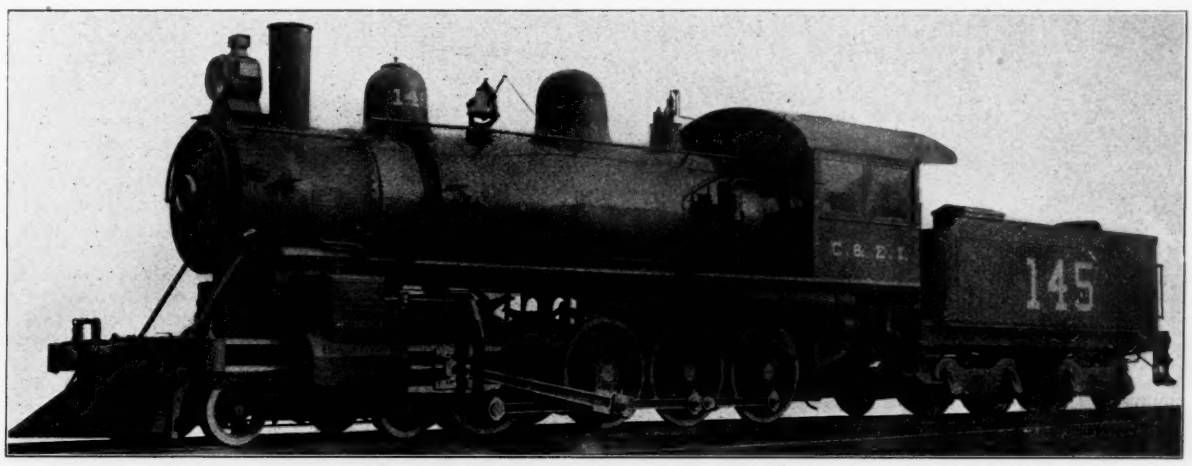
Twelve-Wheel Compound Chicago & Eastern Illinois Railroad.

The accompanying engraving shows the latest heavy freight locomotive of the Chicago & Eastern Illinois built by the Pittsburg Locomotive & Car Works. This is a two-cylinder compound, 21½ and 33 in. by 30 in., and weighs 182,200 lbs. in working order, the weight on the driving wheels being 144,000 lbs. The driving wheels are 54 in. in diameter, with cast steel centers for the main, and cast iron centers for the other drivers. The boiler is of the extended wagon-top type designed for a working pressure of 200 lbs. There are 288 charcoal iron tubes, 2 in. in diameter and 13 ft. 6 in. long. The heating surface of the tubes is 2,216.7 sq. ft., and that of the firebox 192 sq. ft., making a total heating surface of 2,216.7 sq. ft.; the grate area is 35.7 sq ft. The tender has a capacity of 4,500 gallons of water and 9 tons of coal, and is carried on Fox pressed steel trucks.

The special equipment includes: Main driving wheel centers made by the American Steel Casting Company, Latrobe steel tires, Coffin process axles furnished by the Columbia Steel Company, Nathan sight-feed lubricators and injectors, Cooke & Strong bell ringer, front and back couplers made by the National Malleable Casting Company, Crosby safety valves and mufflers, Leach sanding device, Westinghouse engine and tender brakes, National hollow brake beams, Ross-Mehan driver brake shoes, Ashcroft steam gage, A. French springs and United metallic packing.

Other dimensions of the locomotive are given in the following list:

Gage	4 ft. 8½ in.
Kind of fuel to be used	Soft coal
Wheel base, total, of engine	26 ft. 2 in.
" " driving	15 ft. 6 in.
" " total (engine and tender)	54 ft. 6 in.
Length over all, engine	41 ft. 6½ in.
" " " total, engine and tender	66 ft. 5 in.
Height, center of boiler above rails	8 ft. 5¾ in.
" of stack above rails	14 ft. 9¾ in.
Truck wheels, diameter	28 in.
Journals, driving axle, size	8½ x 10 in.
" truck " "	5 x 10 in.
Main crank pin, size	6½ x 6½ in.
Piston rod, diameter	4 in.



Chicago & Eastern Illinois Twelve-Wheel Two-Cylinder Compound Locomotive.

Main rod, length center to center	8 ft. 4 15/16 ft.
Steam ports, length	H. P. 18, L. P. 21 in.
" " width	H. P. 1⅜, L. P. 2 in.
Exhaust ports, length	H. P. 18, L. P. 21 in.
" " width	H. P. 3, L. P. 3½ in.
Bridge, width	1½ in.
Valves, kind of	American balance
" greatest travel	H. P. 5, L. P. 6 in.
" outside lap	1 in.
" inside clearance	H. P. 5/32, L. P. ½ in.
" lead in full gear	H. P. 1/16, L. P. 3/32 in.
Boiler, material in barrel	Steel
" thickness of material in barrel	5/8 and 11/16 in.
" diameter of barrel	64 in.
Seams, kind of horizontal	Butt joints
" " " circumferential	Double riveted
Thickness of tube sheets	½ in.
" crown sheet	7/16 in.
Crown sheet stayed with	Radial stays
Dome, diameter	32 in.
Firebox, length	10 ft. 6 in.
" width	3 ft. 5 in.
" depth front	69 5/8 in.
" " back	66 5/8 in.
" material	Steel
" thickness of sheets	3/8, 7/16 and ½ in.
" brick arch	No
" water space, width....Front 4 in., side 3½ in., back 3½ in.	
Grate, kind of	Cast iron
Smokebox, diameter	65½ in.
" length	68 11/16 in.
Exhaust nozzle	Single
" "	Permanent
" " diameter	4¾ in.
" " distance of tip below center of boiler	10½ in.
Netting	Plate
" size of perforation	1½ x 7/8 in.
Stack	Straight
" least diameter	16⅞ in.
" greatest diameter	16⅞ in.
" height above smokebox	3 ft. 7½ in.

Tender.

Type	Eight wheel
Kind of material in tank	Steel
Thickness of tank sheets	1/8 and ¼ in.
Type of under frame	Steel
Type of truck	Fox pressed steel
Truck with	Rigid bolster
Type of truck spring	Elliptic
Diameter of truck wheels	33 in.
Diameter and length of axle journals	5 x 9 in.
Distance between centers of journals	76 in.
Diameter of wheel fit on axle	6⅜ in.
Diameter of center of axle	5⅜ in.
Type of truck bolster	Fox pressed steel
Length of tender frame over bumpers	22 ft. 8 in.
Length of tank	20 ft. 6 in.
Width of tank	9 ft. 8 in.
Height of tank, not including collar	50 in.
Height of tank over collar	62 in.
Type of back drawhead	Automatic coupler
With or without water scoop	Without

Stresses in Rails Under Moving Loads.

At the December meeting of the New York Railroad Club, a short paper by Dr. P. H. Dudley was read, in which were given some general considerations of the problem of determining the stress in rails under moving loads. The following is from his paper:

It is known to many in this audience that the problem of calculating the stresses in rails under moving trains is so complex that it has not yet yielded to mathematical analysis. The rail in distributing the wheel loads of the locomotive and cars to the ties, acts as a continuous girder, the stresses under each wheel in stiff rails modifying the stresses of adjacent wheels. Whether the wheel-load sets up stresses of tension in the base of the rail directly under the wheels, or stresses of compression on either side, where contrary flexures take place, work is being performed to carry the wheel-loads, or the weight of the locomotive, as though concentrated at its center of gravity.

At the London session in 1895 of the International Railway Congress, the opinion was expressed that it was very important to ascertain the fibre stresses in rails under moving trains, but that they could not at present be calculated.

As reporter for this country on the "Nature of the Metal for Rails" for the Paris session in 1900, I have by means of my stremmatograph recorded the strains on metal sides for 5 in. in length of the base of the rails under a large number of locomotives and trains and have forwarded the results. On 100-lb. rails records of speeds as high as 65 miles per hour have been secured. on 80-lb. rails speeds up to 50 miles, and on lighter rails lower speeds. [For numerous stremmatograph determinations see the Railroad Gazette, May 20 and Oct. 21, 1898.]

The strain on the slides are measured under a microscope, and the apparent fibre stresses computed from the modulus of elasticity of the steel.

The records show that the intensity of the fibre stresses under fast trains is of very short duration, only a fraction of a second, and is quickly followed by strains of an opposite character. It is this small time duration which permits much larger fibre stresses in rails than is permissible in bridge members, where the stress may be of several seconds duration, and must in no case reach the "elastic limit" of the metal.

As a rule, the strains recorded under locomotive truck, tender and driving wheels do not follow in all cases the supposed static wheel-loadings. Transfers of the loading seem to take place through the flexibility of the track and flexibility designed in the construction of the wheel-base of the locomotive. At slow speeds and under some conditions of track the front truck wheel in depressing the rail, ties, ballast and roadbed, often produces a greater stress than the drivers with double the supposed static load. At high speeds this feature has not been found so pronounced, though it is liable to be so on track in poor condition. On 100-lb. rails at speeds of about 20 miles per hour two locomotives of the same class were tested, and it was shown that the sum total of stresses to carry each locomotive agreed with each other within less than 1 per cent., though the stresses under individual wheels varied several thousand pounds. After the speed has increased and dynamic forces generated, such close comparisons cannot be expected, for the center of gravity of the tender and engine might not continue to act together.

The transfer of load per wheel has been found to be very large when the locomotive was running only five or six miles per hour, using its maximum power to start the train. Such transfers are quite independent of the counterweights. The irregular stresses found under the driving wheels or the other wheels of the locomotive, are not uniform for every locomotive, but vary with the construction, wheel spacing, steam admission and speed. A locomotive which has run many thousand miles produces higher stresses than when just from the shop with the wheels in good condition. To note the position of the counterweights as they pass over the stremmatograph, the locomotive is photographed in one-hundredth to one-thousandth of a second, according to the speed of the train.

Improvements on the Lehigh Valley.

In reviewing lately the annual report of the Lehigh Valley Railroad Co., we called attention to the large and continuing expenditures for improvements. A few particulars of the nature of those improvements are given below, reprinted from the Report. Expenditures have been made for:

First.—The substitution of heavy engines for lighter ones, the retirement of four-wheel coal car equipment, and the addition of large box cars to replace those of lighter capacity. The replacement of engines must be continued during the coming year.

Second.—The construction of additional tracks for yards and passing sidings, together with the lengthening of many sidings to hold longer trains, as a result of the heavier locomotives now in use. The practice in existence during and previous to 1897, of extensively using main tracks for passing sidings, which resulted not only in serious delays to your traffic, and would be prohibitory with its present volume, but which was as well a prolific source of accidents, will, with such additions as have been

made, and should be made in the coming year, largely cease.

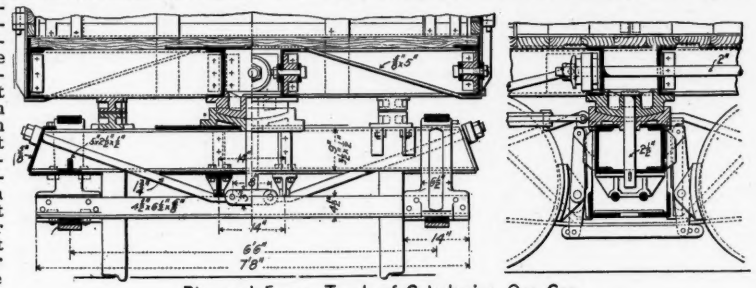
Third.—The substitution of new bridges for old ones, to carry the heavier locomotives and cars now in use. There yet remain important structures on your Main Line which must be renewed for the same reason, and of this work a very considerable amount must be done during the coming year.

Fourth.—Extension of the block signal system over your Main Line. At the time the present management took charge of the property, the block signal system was in operation on only 237.82 miles of track. Since then it has been extended 55 miles additional, of which 49 miles were constructed during the year just closed, at which time there remained 633.7 miles of Main Line track still to be covered. The necessity of pressing this work to completion as rapidly as possible will, it is believed, be manifest to the shareholders.

Fifth.—A systematic concentration of shop work. The general shops heretofore in existence at Hazleton and Delano have been permanently closed. The foundry at Weatherly has also been closed, and all castings are now purchased in the open market. The buildings at Weatherly have been remodeled, and opened for such light repairs as are incident to the operation of engines on the Mahanoy and Hazleton Division. The freight-car repair shop at the same place is now being used for the repairs of frogs and switches for the entire system. Work heretofore performed in the passenger car shops at South Easton, Hazleton, Delano, Ithaca, and Cortland has been concentrated at Sayre, at which place suitable facilities have been provided. By alterations at South Easton and additions at Sayre, the shop capacity for engine repairs has been increased. The final completion of the additions at South Easton has been postponed temporarily, but when finished will further increase the shop capacity, and admit of greater concentration of engine repairs. The heavier repairs on all coal car equipment are now being made at Packerton, those on all other car equipment, freight as well as passenger, being provided for at Sayre.

A successful issue of the undertaking in hand requires that the company shall be able to maintain the volume of business, and that it shall do this at a minimum cost of operation, in order that a point may be reached where a portion of the company's earnings may be available for distribution among its shareholders. That this may be done, the portions of your line which are still crowded or congested must be supplemented with additional tracks, or, when cheaper, by alternative lines. Otherwise the volume of traffic must fall off because of inability to handle it. As such additions to your track system will, of necessity, be a matter of time, your management is impressed with the urgency of beginning during the coming year such work as may be necessary to give the relief required at badly congested points, especially between Penn Haven Junction and Packerton, and at and around Bethlehem.

Of the present large capitalization of the company no inconsiderable part stands for investments which, though of value, are unproductive up to the present time. This circumstance, together with the fact that work of a general character like that contemplated has been already carried out on other systems in past years, and has been gradually paid for out of increased earnings which such work produced as it progressed, leads your management to feel that to a liberal extent your company should for the present charge such work to operating expenses. In their opinion your credit should be used for such work only as cannot be delayed until the necessary amount of money to pay for the same can be provided from the earnings of the property.



Diamond Frame Truck of Caledonian Ore Car.

Fifty-Ton Ore Car of the Caledonian Railway.

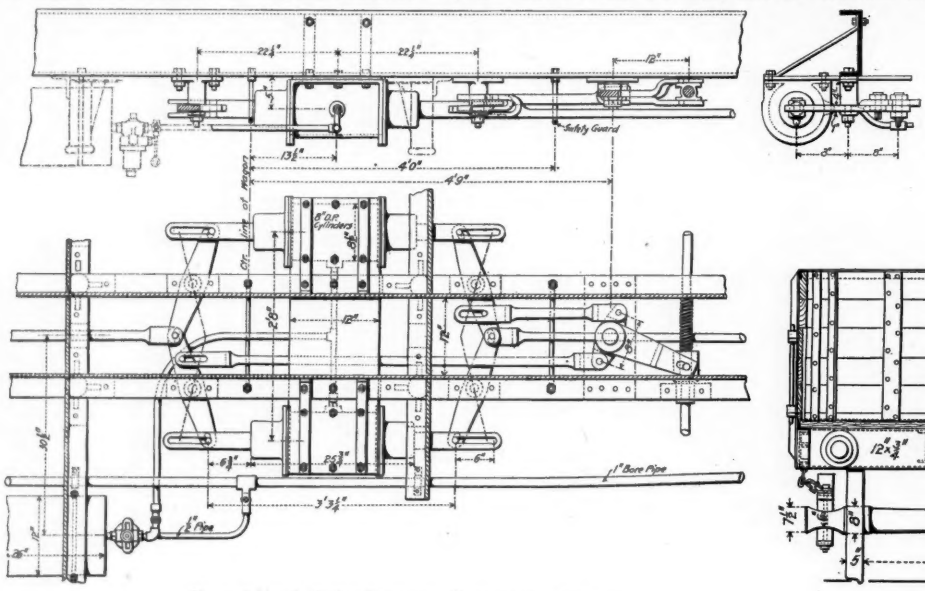
Mr. J. F. McIntosh, Locomotive Superintendent of the Caledonian Railway, has recently built some 50-ton gondola cars at the St. Rollox Works, Glasgow, that have many features in common with American practice. These cars will be used for hauling ore between the harbors and blast furnaces on the company's lines. The length over end sills is 35 ft. and between truck centers 23 ft. 6 in. The length inside is 34 ft. 7 in., the width, inside, is 7 ft. 7 in., and the sides are 4 ft. high. The trucks have a wheel base of 5 ft. 9 in.

Besides their unusual size for a British railroad, these cars are interesting on account of the underframing, which is of rolled steel shapes. No intermediate sills are used, and the side and center sills are 10-in. channels and the end sills 12-in. channels; angles are used as bracing, and extend from behind the side buffer to the center sills, being connected just in front of the body bolster. The corners are strengthened by cover plates, and there are two cross-ties in addition to the needle beams. Each body bolster consists of two parallel channels spaced 1 ft. apart, and joined to the center and side sills by corner angles; in addition a ⅝ x 5 in. tension plate extends over the center sills and is riveted at either side to the bottoms of the side sills. Each longitudinal sill is trussed, the truss rods ending back of the body bolsters in pin joints.

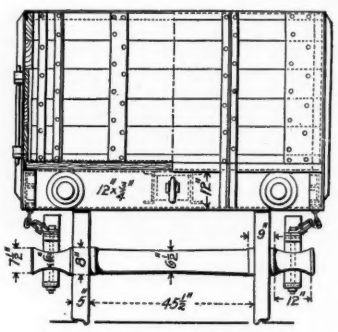
The floor consists of 2½-in. planks, covered with ⅛ in. steel plates. The sides also are wood and are held in place by stakes of T section and diagonal angles. There are three pairs of unloading doors in either side of the car, one being at the middle and one above either truck. These door openings are about half the height of the car sides, 4 ft. 5 in. wide, and the doors are hung at the sides.

The trucks are of the American diamond frame type, the bolsters being made of two 9-in. channels placed parallel and fitted with cover plates and truss rods. The wheels are 38 in. in diameter, and the axles, which are 6½ in. in diameter at the center and 8 in. in diameter at the wheel fit, have concave journals, 12 in. long and 6 in. in diameter at the smallest section and 7½ in. at the ends.

As shown in the engravings, the hand-brake can be worked from either side of the car by a simple arrangement of levers operated from a cross-head by a nut on a right and left handed screw shaft extending from side to side of the car. The cars are also equipped with the Westinghouse air brakes.



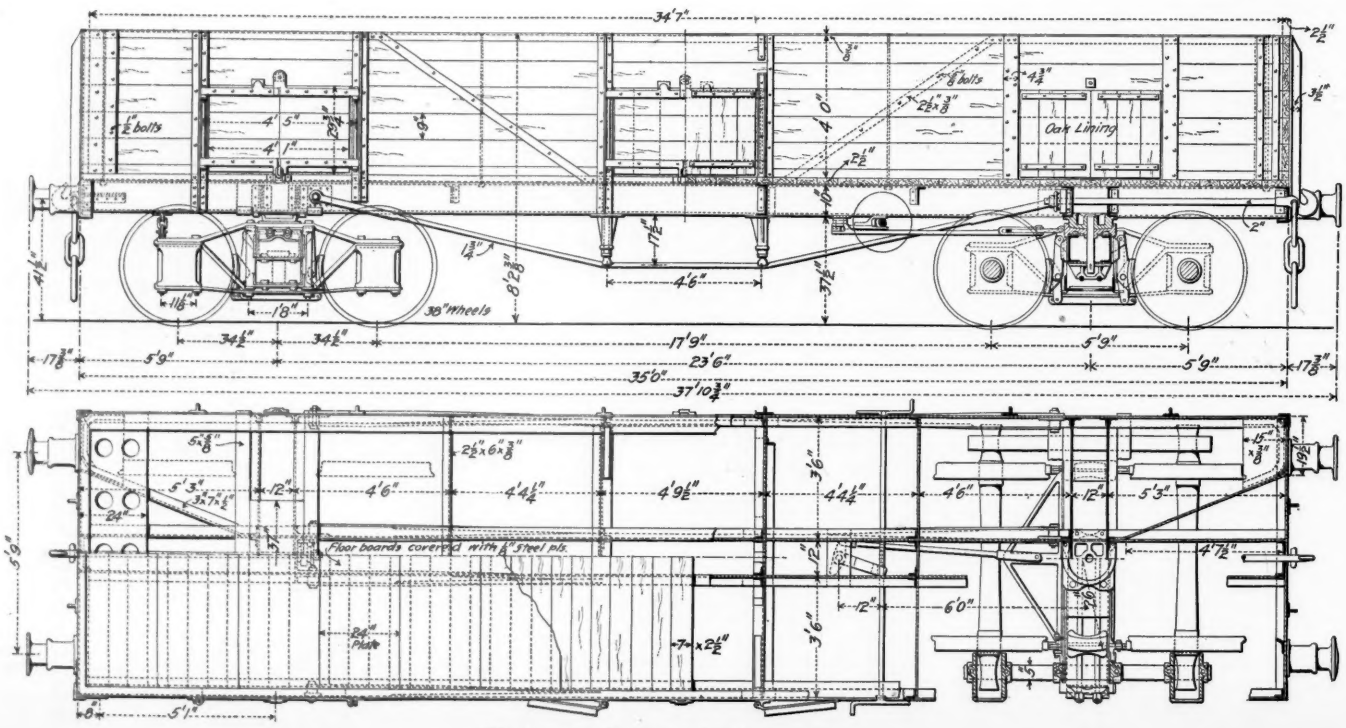
Air and Hand Brake Rigging—Caledonian Ore Car.



End Elevation.

A Railroad Siege Train.

In the war now going on in South Africa there are bound to be interesting developments of the applications of the railroad to war quite apart from the matter of carrying troops and supplies. We have already mentioned briefly the armored trains. Messrs. Kerr, Stewart & Co., Limited, of Stoke, England, have recently turned out cars and locomotives for a siege train. The inquiry for this was received at the London office of the firm Nov. 13. Nov. 18 an order was given for two narrow gage locomotives, five miles of straight track and one mile of curved track, with steel crossties, 30 sets of switches and crossings, two sets of diamond crossings, 24 four-wheel cars



Fifty-Ton Ore Car of the Caledonian Railway.

to carry 3½ tons each; 15 eight-wheel (bogie) cars to carry six tons each, and two six-ton brake vehicles also on bogie trucks. The majority of the work was inspected and passed by the War Office Nov. 22, four days after the receipt of the order, including Sunday. All of the material was completed and shipped within 10 working days of the receipt of the contract.

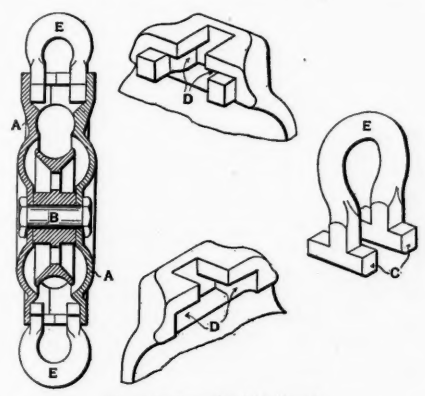
It is needless to say that the material was not all made in this time; part of it was in stock, part of it was taken from other orders more or less advanced and part of it was procured from other manufacturers. The switches and crossings were made at the company's works after the receipt of the order, and the mile of curved track was also bent to template in that time. The company had in stock the channel iron for the four-wheel cars and a few chilled cast-iron wheels. Some of the channel iron for the bogie cars was also in stock; the rest was bought in Liverpool. The springs were made in Sheffield and the chilled wheels in Edinburgh, being inspected at once by the representatives of the firm and shipped to the works by passenger train. The locomotives had been designed for the Egyptian Government, and were partially completed. The frame plates were in stock, but no work had been done on them. The erection work was begun, however, Nov. 15, in anticipation of the receipt of the order. These engines were actualy dispatched on the 22d, having been run for two days in the presence of the War Office authorities. Some of the men engaged on this part of the order worked three days and three nights without stopping.

The engines have four drivers coupled and no trucks, the cylinders are 6 x 10 in., and the gage 24 in. They carry side tanks. The weight in working order is 6t. 12cwt. The cars are designed especially to carry cannon and are of such dimensions that the wheels of the gun carriages made come down either side of the floor of the car, hanging astride. The rails for the temporary track are 20 lbs. per yard. Probably we shall hear of the use of this outfit in the siege of Pretoria before many months pass.

A New Tackle Block.

The tackle-block shown herewith is the invention of Mr. Alfred B. Tarbox of the Boston & Lockport Block Co., Lockport, N. Y. It is strong, simple in construction and is intended to lessen considerably the wear on the rope used. It is made up of six main parts, namely, two cheek pieces, two shackles, a bolt B, and the sheave or wheel. As shown, at the upper and lower ends the cheek pieces, A, are provided with interlocking lugs. The square shanks, C, of the upper and the lower shackles fit into the cheek pieces at D, thus bringing practically all the stress in line with the cheek pieces, A.

In the single sheave block as here shown cheek pieces are made of metal, either by casting or by striking up sheet metal at their ends, so as to interlock when brought together. No machine work or fitting is required after the parts have been thus made and they can be very quickly assembled, no



The Tarbox Tackle-Block.

rivets being required. The bolt B holds the cheek pieces together. Blocks similar in general construction with more than one sheave are also made by this company.

The A. B. C. Journal Bearing.

The Atlantic Brass Company was organized less than a year ago to make a patented journal bearing, as well as brass, steel and iron castings of every description. Since then the company has applied A. B. C. bearings to cars on more than 60 railroads in the United States and has built at Communipaw, N. J., a factory where about 400 complete bearings are made each day. Plans are being drawn to add to this plant a building 65 ft. x 290 ft. When this is finished, about July 1, castings of brass, graphitic steel, and malleable iron will be made in large quantities.

Fig. 1 shows a floor plan of the present building. Power is supplied by an engine of 45 h. p. with a 65 h. p. boiler, and the building is lighted by a 4½ k. w. dynamo. In the machinery room is a blower used to feed air to the cupola, melting furnace and anealing ovens and the necessary machinery for finishing the bearings, consisting of a Bement-Miles

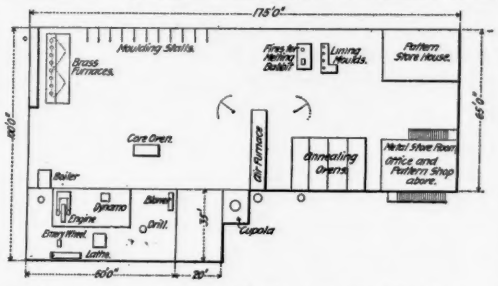


Fig. 1.—Floor Plan of Atlantic Brass Co.'s Works.

boring machine, lathes, emery wheels and drill press. In the cleaning room are four revolving cleaning barrels, the company's own design and make.

The air-melting furnace is of special design, with a capacity of 15 tons a day. Two of the annealing ovens are working; the third is being built.

The A. B. C. bearing and wedge is shown in Fig. 2

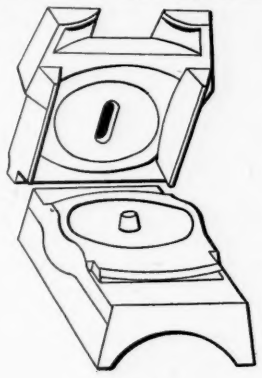


Fig. 2.

and Fig. 3 shows a section of the bearing cut through the center. The method of applying the steel back to the bronze is interesting (see Fig. 4). After being removed from the annealing ovens, where they are kept in a temperature of 1,600 degrees for five days, allowed to cool gradually for about 48 hours and

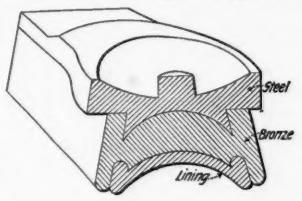


Fig. 3.

Fig. 4.

cleaned, the backs are coated with a deoxidizing solution, then heated to about 600 degrees and placed in a steel mould having four cores to correspond with the holes in the steel back. The melted brass is poured, the deoxidizing mixture dispelling the oxygen and giving a homogeneous weld, free from blowholes. The bearing is then ready for the application of the Babbitt metal lining.

The advantages claimed for the A. B. C. bearing are that it fits all M. C. B. and old style bores; interchanges with and fits M. C. B. brasses; minimum first cost, and minimum friction, the bearing surface covering only one-fourth of the surface of the axle journal. The double concave and convex surfaces of the bearing, as shown in Fig. 2, allow the wedge to ride on the steel back of the brass, distributing the weight equally and providing a cushion for side thrusts on curves. Bearings put in service in March, 1899, are still running and in good condition. A number of bearings have been severely tested in service under steel cars of 80,000 and 100,000 pounds capacity.

The office of the company is at 192 Broadway, New York City.

The Latent Heat of Aluminum.

By E. Grafstrom, M. Am. Soc. Mech. E.

In a paper on aluminum published last year in the Zeitschrift für Electrochemie, Mr. M. Goldschmidt calls it a heat-accumulator, because by using this metal as a reducing agent a heat energy can be dedeveloped corresponding to that required for the original production of the metal. When aluminum unites with oxygen the reaction is attended by a considerable amount of heat, estimated by Mr. Goldschmidt to be as high as 5,400 deg. Fahr. This reaction will not take place until the metal is heated to a red-heat, and not even then unless it is in the form of fine powder; if in a mass or large piece, the metal, when heated, becomes covered by a thin coating of oxide which protects it and prevents further action.

The reducing ability of aluminum at high temperature can be utilized in the production of pure metals Mr. Goldschmidt having recently exhibited a piece of chromium weighing 55 lbs. produced by this process. The intense heat caused by the reaction may also be found useful for many practical purposes, when a high temperature of short duration is needed.

By way of experiment the writer has followed out the suggestions laid down in Mr. Goldschmidt's paper, and as some of these experiments may be of interest to others, he will describe the devices he has been using.

In order to heat a large rivet or pivot pin, of the kind used in bridge construction, for the purpose of riveting over the end, or otherwise changing its form, without access to a blacksmith shop or portable forge, the writer has used the arrangement shown in Fig. 1. A pasteboard box, A, was filled with a mixture of aluminum powder, iron oxide and fine sand, and in this mixture the rivet or pin, B, was packed. The proportions of the mixture were as follows, with the weight of the rivet as unit:

Aluminum	.50
Iron oxide	1.25
Sand	.25

A piece of paper was rolled up and fitted into a hole cut through the top of the box, and the funnel, C, thus formed was packed with a mixture of aluminum and lead oxide (litharge) in the proportion of 1 to 5. Lead oxide is more easily reducible than the iron oxide, but on account of its cost it was used only for starting the reaction. A magnesia ribbon, D, served as a fusee. In order to retain the heat the whole thing was buried in a box with sand, as shown. The magnesia wire was lighted and started the reaction of the mixture in the funnel, which communicated its heat to the main body surrounding the rivet. As soon as reaction in this mixture com-

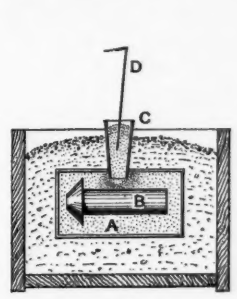


Fig. 1.

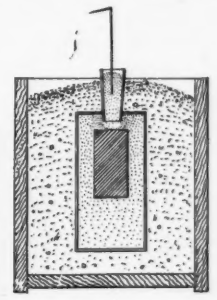


Fig. 2.

menced, a shovel of sand was thrown over the whole in order to prevent the escape of heat upwards; after five or six minutes the rivet was dug up white-hot and ready to be worked.

For the purpose of melting a small piece of cast iron the same arrangement was used, except that the pasteboard box containing the principal mixture was buried upright in the sand, and the cast iron was placed in the upper end, as shown in Fig. 2; The proportions of the mixture in the box, A, were varied in order to produce a more intense heat, by omitting the sand and using aluminum and iron oxide in the ratio of 2 to 5, which the writer found to give the best results with the ingredients available, consisting of the aluminum powder put up in ½-lb. packages for "bronzing" in paint shops, and the commercial ferric oxide, Fe_2O_3.

The mixture was well rammed in around the cast iron. The writer used about 2½ lbs. of this mixture per pound of cast iron melted.

At a similar experiment a piece of malleable iron was substituted for the cast iron. It had not been thoroughly converted, and the cast iron on the inside melted and ran out leaving a hollow crust of malleable iron shown in Fig. 3.

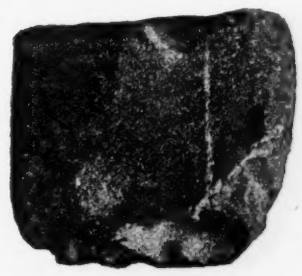


Fig. 3.

The price of aluminum is about 37 cents per pound in Pittsburgh, but the powdered metal is quoted considerably higher. Mr. Goldschmidt claims that he has welded together 1 in. steel tubes at a cost of about five cents per joint for material. In welding steel the principal difficulty seems to be to graduate the proportions of the mixture so that the steel will not be burnt by too high temperature. This can be regulated by the quantity of sand used. For melting iron the process can be made continuous by using a crucible with an opening at the bottom for drawing of the molten metal, while the iron and the aluminum mixture are fed in through the opening at the top.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY,
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to improvements. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

One of the principal questions in connection with the rampant rate cutting which is reported from Chicago since February 11 is as to whether the reductions are legal or illegal. So far as we can learn, the low rates which it is generally agreed are being accepted by all of the roads for export grain to the Atlantic seaboard are not published and not filed with the Interstate Commerce Commission. All rates were to have been restored on Feb. 11. This "restoration" was the first definite acknowledgement that rates needed restoring. Then came the report that the heavy shippers were to be allowed to continue sending grain at the old rates for some time, by adopting the fiction that the shipments had started from some place or other before the advanced rate took effect. Subsequently the reports of cutting made no mention of this time proviso, and it is to be concluded that the low rates are now to be had on every road, by those shippers who know how to apply for them. Now, if Mr. Knapp's conferences with the presidents, where each road promised to maintain its published rates, are really to be credited with the improved conditions which followed the conferences, everybody will want to know why a promise should be so effectual for a limited time and yet be so worthless after a few months. It would seem to be in order for Mr. Knapp to call another conference. If any railroad has more cars than it can profitably use, it is not to be expected that it will refrain from reducing its rate to get grain, if a reduction is necessary; but if the law requiring publicity is to be kept on the statute book the Interstate Commerce Commission should find out where, when and to what extent such reductions go beyond the published tariffs. Another question of interest is whether there really is a scarcity of traffic, such as is usually put forth as the cause of rate wars. Until quite recently every manager has continued to assert that freight was plenty. Can it be that this is still the case, but that grain at 12 cents to New York affords a better profit than can be got from miscellaneous business? Or is it necessary that each traffic manager keep his regular and heavy grain customers even at the sacrifice both of the interests of other freight traffic and the profit on the grain?

A number of members of the Chicago Board of Trade have published a letter which they sent, last week, to Mr. J. Pierpont Morgan of New York, as the "foremost representative of the railroad financial interest," in which it is asserted that small dealers in grain are now suffering gross discrimination in freight charges to the Atlantic seaboard. These small dealers say that they have practically lost all of their business connections by this favoring of large firms. We do not know what weight should be attached to the utterances of this committee, as there is no information at hand as to how much business it represents, and we do not recognize the names of the signers to the letter; but the tone of their argument indicates honesty and respectability. The main point of the argument is predicated on a statement in Chairman Knapp's speech at Chicago last fall, that transportation is a function of government and therefore should be open to all on equal terms. We find no fault with this theory, and we hope that these grain dealers will so thoroughly expose those other grain dealers who secure secret rates and thus make themselves liable to punishment for misdemeanor, that Mr. Knapp can bring them and the railroad law-breakers to justice. Equal terms may not, however, mean the same rate per bushel on corn from a small shipper, as on shipments made from the largest elevator in Chicago. Even where a railroad makes rates to enable small dealers to keep even with large ones it is not always giving equality; more likely it is favoring the smaller concern for political reasons. The interest of the corn grower and the corn consumer are the first to be considered in making grain rates from Chicago to New York, and it may be that these demand lower rates for 100 carloads than for one car load. We are not defending secret rates, but merely recalling the fact that publicity of rates is not synonymous with equality. Judge Knapp spoke for equal rates "under like conditions."

A letter from Chicago grain dealers to Mr. J. Pierpont Morgan—published as soon as written—is of interest chiefly as an indication of Chicago sentiment; for, as every one knows, Mr. Morgan is already doing everything in his power to enforce stability of rates. A somewhat similar document emanates from St. Louis. There, as at Chicago, there is some little agitation looking toward the cure of railroad rate difficulties; and, as in Chicago, it is so hard to define a policy which shall merit general approval, that individual agitators—or small companies of them—find that about the only thing they can do is to lay their plans before the public, and rest there. The St. Louis document which we refer to is from Mr. C. F. G. Meyer, a prominent wholesale merchant. He desires the passage of the Cullom bill; but only on condition that it be amended so as to make it workable. He points out the absurdity of a national body trying to frame a freight classification which will neither destroy nor unjustly build up businesses, and that will be just to carrier and shipper; the Commission could not get time to listen to one-twentieth of the complaints that would be presented to it. If a Commission is to do anything for the merchants it must be divided into "Circuits," like the Federal Courts, and each railroad district be a Commission district. Each district chairman should belong to the central Commission. The district Commission should have two business men, two railroad men and a lawyer, all with life tenures; in short, the body should be high-minded and as dignified as a court. The letter contains other suggestions, some not so commendable; but we note these as a hopeful indication that merchants are taking a more intelligent interest in transportation questions. Mr. Meyer says that the honest business man is willing to trust his fortunes to a high-minded tribunal such as is described. But how about the honest railroad man? Judge Cooley was as high-minded a man as ever dispensed law; but he deemed it his duty, when acting under the Interstate Commerce law, to lean toward the side of the public.

Train Accidents in 1899.

The accident record for the calendar year just closed shows the largest total in our history, as was to be expected from the great expansion in railroad traffic attendant upon the revival of business, and as has been foreshadowed by the monthly records.

The number of passengers killed, which is the most accurate item in the record, and the one which is of most immediate interest to the majority of readers, is very much larger than it was in 1898. Indeed the year 1898 is the smallest but one, in this respect, to be found in the whole list. Of the 113 passengers killed in 1899 nearly one-half are charged to two months, January and May. In the former month occurred the butting collision at West Dunellen, N. J., where 16 passengers were killed; and the record for May includes the rear collision at Exeter, Pa. (28 passengers killed). Deducting these two collisions, the total number of passengers killed still remains 5 per cent. larger than in 1898. Though only 3 per cent. above the average for the past five years.

As is apparent from Table No. 2, much the larger share of all the casualties occur in accidents classed as due to negligence in operating; and in the present report this class includes 77 per cent. of the fatalities to passengers.

In spite of the unfavorable aspect of these figures the record of 1899 confirms, in a general way, the conclusions which we drew from the record of 1898, that security of life and limb on American railroads is being gradually improved. The number of accidents increases with the number of trains run, but the number of deaths and injuries does not increase in the same ratio.

The large table, No. 1, is made in the same form as in previous years and is self-explanatory. There have been added, however, two sub-classes, one under defects of equipment and one under negligence in operating, both made necessary by the use of power brakes on freight trains. Automatic application of air brakes is due, in the majority of cases, to failure of the flexible air-brake hose between the cars. In those cases where the brake couplings are violently pulled apart by the failure of the car coupling or draw bar the fault is not, of course, to be charged to the brake apparatus, and we have therefore made a separate class of this latter kind of cases. Neither are we to charge the derailment or crushing of cars to the brake, in the other class. When the brake is automatically applied in consequence of a rupture of the hose it is doing just the thing that is required of it, and as every one knows, the collision or derailment is due to the fact that part of the cars and not equipped with power brakes, or that the slack of the train is not properly managed.

The air-brake troubles classed under negligence are those in which the accounts indicated that the engineman failed to exercise due care in taking up the slack of the train.

In October the list showed the largest number of train accidents that we ever recorded in a month; while in September we reported a larger number of accidents which were attended with fatal results than in any previous month except two, September and October, 1890.

The total number of casualties to persons recorded during the past seven years is shown by years in the following table:

	1899.	1898.	1897.	1896.	1895.	1894.	1893.
Passengers killed	113	46	62	128	38	58	178
Emp killed	402	325	276	318	302	280	424
Others killed	74	55	79	91	75	104	89
Total killed	589	426	417	540	415	442	691
Passengers injured	888	616	632	618	761	410	1,240
Emp. injured	1,095	1,024	727	901	739	845	1,243
Others injured	78	61	113	78	95	88	101
Total injured	2,061	1,701	1,472	1,297	1,535	1,343	2 584
Train mileage, millions*		805.0	858.0	850.7	834.2	818.4	889.4
No. persons killed per million train miles		0.651	0.485	0.616	0.497	0.540	0.777

* Estimated.

The relative frequency of the more prominent causes of collisions for six years past is shown in the following table:

	1899.	1898.	1897.	1896.	1895.	1894
Train breaking in two	151	143	155	93	96	88
Misplaced switch	87	63	48	51	42	50
Failure to give or observe signals	98	115	58	33	64	54
Mistake in giving or understanding orders	70	47	33	48	35	31
Miscellaneous	240	246	149	99	117	166
Total explained	646	614	443	324	354	389
Unexplained	495	398	288	190	248	224
Total	1,141	1,012	731	514	602	613

The cause of the worst collisions of the year were discussed in these columns in connection with the monthly records. It is worthy of note that two of them, Exeter (May) and Paterson (November), occurred on roads where the prescribed time interval between trains is only five minutes. In September we had to record an unbroken list of a dozen butting collisions due to mistakes in giving or understanding orders, and cognate causes. But while the time-interval method of running trains has been brought into uneviable prominence it is only fair to note that serious collisions of passenger trains have occurred where the space-interval method is in use. A reference to three such collisions may be found in our March record.

The present record is made up from the detailed accounts which have ben published monthly during the year. The principal source of information is the local press throughout the country, and there is, of course, no pretense of completeness. In the majority of items the facts are given as we find them reported, but with inaccurate or exaggerated statements eliminated. In the cases of the more prominent accidents, especially those in which passengers are killed, or where the details of the occurrence or an explanation of the causes will be interesting or instructive to railroad men, the report is verified by inquiry of the superintendent of the road involved. In the classification of the causes of the accidents, somewhat arbitrary rules have to be followed. Where two or more causes combine to produce an accident, the case is classified according to the principal cause.

The number of street railroad accidents occurring in 1899, according to the accounts which we have gathered, was 181. The number of persons re-

TABLE NO. 1.—TRAIN ACCIDENTS—THEIR NATURE AND CAUSES, FOR TWENTY-SEVEN YEARS.

	1899.	1898.	1897.	1896.	1895.	1894.	1893.	1888-92. †	1883-87. †	1878-82. †	1873-77. †
TRAIN MILEAGE in United States in millions of train miles*	950 0	905.0	858 0	850.7	834.2	818.4	889.4	.....	.....	.....	.....
COLLISIONS :											
Rear	489	473	355	228	301	280	455	464	342	275	150
Butting	246	232	158	129	109	134	223	286	174	121	96
Crossing and miscellaneous	406	307	218	157	192	199	318	209	32	21	44
Total collisions	1,141	1,012	731	514	602	613	996	959	548	417	295
DERAILMENTS :											
Broken rail	22	19	25	26	42	32	71	49	68	48	71
Loose or spread rail	26	26	23	16	16	35	57	47	66	34	31
Broken bridge or trestle	20	21	26	19	16	23	20	38	32	27	24
Broken or defective switch	20	17	13	9	9	16	41	27	13	3	9
Broken or defective frog	4	6	3	3	5	5	16	11	11	2	5
Other defects of road	6	5	6	5	8	3	9	3	1	2	9
Total defects of road	98	94	101	78	95	114	214	175	191	116	149
Broken wheel	59	52	42	42	33	33	48	40	33	28	22
Broken axle	111	113	77	74	70	71	88	55	49	36	32
Broken truck	31	36	3	24	20	18	31	28	15	11	10
Failure of coupling or drawbar	34	28	24	16	17	27	21	1	4	1	4
Fall of brakebeam	16	14	14	9	14	20	19	16	5	.....	3
Automatic application of air brakes	12	...	.....	.....	.....	...	....	.....	.....	.....	.....
Same, due to failure of drawbar	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Other defects of equipment	31	28	23	23	23	23	26	18	2	3	5
Total defects of equipment	300	270	214	188	177	182	241	179	108	79	76
Misplaced switch	38	42	39	28	48	53	67	71	69	77	76
Derailing switch	14	13	9	5	7	..	..	.....	.....	.....	.....
Negligence of trackmen or bridgemen	12	8	4	2	8	6	14	8	5	5	9
Runaway engine or train	9	16	14	6	8	1	4	10	2	2	2
Open draw	3	2	6	2	3	4	4	3	4	3	4
Too quick application of air brake	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Other negligence	48	25	19	23	17	39	48	32	5	4	6
Total negligence in operating	130	106	91	66	91	103	137	124	84	91	97
Animals on track	28	55	23	24	21	38	50	53	33	39	48
Snow or ice	2	10	8	9	16	12	16	9	17	13	20
Washout	21	9	21	23	17	5	16	19	21	21	28
Land slide	32	17	20	20	25	31	27	29	16	7	6
Accidental obstruction	25	19	21	26	33	19	32	21	32	32	38
Malicious obstruction	22	9	18	28	40	62	51	39	30	13	15
Other unforeseen obstructions	6	8	3	7	2	11	5	8	8	3	3
Total unforeseen obstructions	136	97	114	146	154	178	197	178	157	128	158
Others	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	5
Unexplained	563	577	353	314	293	296	423	384	184	231	224
Total derailments	1,227	1,144	873	792	810	873	1,212	1,031	723	646	709
ACCIDENTS WITHOUT COLLISION OR DERAILMENT :											
Boiler explosions	19	19	11	15	12	9	24	17	15	14	10
Broken parallel or connecting rod	12	8	13	6	10	12	8	11	22	14	10
Cars burned while running	11	10	10	4	17	16	15	12	10	8	9
Various breakages of rolling stock	8	16	3	12	8	10	18	24	21	9	16
Other causes	13	19	17	14	28	27	31	29	8	4	6
Total without collision or derailment	63	72	54	51	75	74	99	93	76	46	51

RECAPITULATION.

Collisions	1,141	1,012	731	514	602	613	996	959	548	417	295
Derailments	1,227	1,144	873	792	810	873	1,212	1,031	723	646	709
Other accidents	63	72	54	51	75	74	99	93	76	46	51
Total	2,431	2,228	1,658	1,357	1,487	1,560	2,307	2,083	1,347	1,109	1,055

* Train mileage is taken from Poor's Manual, which gives revenue mileage only; that for 1899 is estimated.
† Average per year, for five years.

ported killed and injured was 600, as appears in the following table:

STREET RAILROAD ACCIDENTS.

	1899.	1898	1897.	1896.	1895.	1894.
Number of accidents	181	133	108	182	117	61
Number of persons killed	66	27	31	37	45	8
Number of persons injured	534	378	355	545	298	100

Measured by fatalities, the street railroad accident record would have been about the same in 1899 as in the two or three previous years, had it not been for the disaster at Stratford, Conn., in August, where 29 persons were killed. The cause of the Stratford disaster—excessive speed on an imperfect track—has figured in a number of other derailments during the year, but in none of these were many passengers endangered. The variety of causes appearing in the street-car accident record is already familiar to our readers. Among those appearing in the record of 1899 are lack of tail lights at night, failure of electric block signals and mistakes of train dispatchers. Three rear collisions occurred in a single month from failure of the electric current in cars which had no oil lamps to serve as rear signals when the electric lights failed. Electric block signals, so-called—automatic apparatus for indicating by an incandescent electric light at or near a side track, whether or not the main track to the next meeting point is occupied—are in use at a number of places, and failure of such apparatus to give the proper indication has been reported as the cause of collisions. But the circumstances of electric car collisions, as reported, often indicate that the custom of injudiciously trusting in the ability of the motor man to control his speed, after coming in sight of an opposing car, is a frequent cause of such collisions.

In a fatal butting collision on an electric line where cars are run at high speeds, due to a mistake in the orders given by the dispatcher or person in charge of the movement of cars, it appeared that this official kept no written record of his work. The stopping of cars on railroad crossings in consequence of the failure of the electric power has been the cause of a number of accidents. These failures are, indeed, too numerous to receive notice in the newspapers; but they are not always followed by disaster, as the locomotive is not always near.

TABLE NO. 2.—CASUALTIES TO PASSENGERS AND EMPLOYES IN TRAIN ACCIDENTS IN 1899.

Tabulated according to classes of causes.

Month.	Defects of road.				Defects of equipment.				Negligence in operating.				Unforeseen obstructions and maliciousness.				Unexplained.				Total.			
	Pass.		Emp.		Pass.		Emp.		Pass.		Emp.		Pass.		Emp		Pass.		Fmp		Pass.		Emp.	
	Killed.	Injured	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured	Killed.	Injured
January	0	15	1	6	0	0	5	5	18	31	25	48	0	13	4	5	3	34	5	16	26	93	40	87
February	1	12	0	8	1	3	5	8	0	19	21	66	0	0	7	12	6	10	2	24	2	44	35	118
March	0	6	1	0	0	27	5	11	1	14	19	48	0	6	6	9	2	27	0	9	3	68	31	72
April	0	0	2	2	0	0	4	5	2	23	6	21	0	0	3	5	0	5	3	6	2	28	18	39
May	1	12	2	4	0	0	1	5	29	71	5	34	5	47	8	9	0	12	6	4	35	142	22	60
June	0	40	4	3	0	2	0	3	1	26	7	54	0	0	2	7	0	35	2	6	1	97	15	73
July	1	13	1	11	0	0	3	6	2	39	13	47	4	18	5	16	2	24	9	20	9	94	31	100
August	0	0	0	2	0	5	4	12	4	31	20	67	0	0	5	5	0	7	2	9	4	43	30	95
September	0	0	3	0	0	1	3	10	10	46	51	100	0	0	0	4	3	33	8	21	13	80	65	125
October	1	24	1	2	0	0	4	8	3	23	17	85	0	1	0	2	0	0	4	10	4	48	26	107
November	0	1	1	0	0	0	5	6	9	71	22	85	0	10	7	15	0	2	8	12	9	85	43	118
December	0	0	0	4	3	13	1	7	8	51	38	77	0	0	4	4	0	2	3	9	11	66	46	98
Year	4	117	16	42	4	51	40	90	87	439	244	727	9	90	50	93	9	191	52	143	113	888	402	1,095
Year, 1898	4	44	19	68	1	36	33	68	19	287	175	680	6	92	42	62	16	157	56	146	46	616	325	1,024
Year, 1897	2	92	27	45	7	95	27	58	28	293	137	451	4	52	47	69	21	100	38	104	62	632	276	727
Year, 1896	11	144	22	42	0	32	48	41	89	310	154	349	23	97	59	84	5	35	35	85	128	618	318	601
Year, 1895	2	106	16	69	4	52	30	73	17	378	157	415	6	43	46	100	9	122	53	82	38	701	302	739
Year, 1894	3	33	23	70	5	19	24	56	127	202	136	462	16	95	61	145	7	61	36	112	58	410	280	845
Year, 1893	15	336	32	121	3	64	47	75	52	634	243	742	1	56	156	167	7	150	46	138	78	1,240	423	1,243
Year, 1892	23	322	39	103	2	85	61	43	178	514	271	718	5	88	72	177	8	117	47	113	116	1,126	490	1,204
Year, 1891	24	291	45	101	7	90	42	65	114	458	345	939	23	116	57	154	9	228	61	188	177	1,183	55	1,447
Year, 1890	19	195	61	126	4	86	30	77	15	624	337	959	24	103	60	165	10	216	81	192	172	1,224	569	1,519
Year, 1889	16	167	30	81	7	58	24	63	46	291	189	565	34	107	53	120	5	122	40	119	108	715	336	978
Year, 1888	5	195	45	153	16	65	35	92	94	388	217	573	11	106	77	163	44	258	60	117	188	1,012	434	1,098

The Trans-Caucasian Railroad, which extends from the Black Sea to the Caspian, has been isolated from Europe by the mighty range of the Caucasus, which extends parallel with it on the north. Now at last it has a connection with the Russian railroad system, not by a line going over or under the Caucasus, but by one built around the range. The old line to the Caucusus from the north reached it about the middle of its length at Vladikaukaz. From this line recently a line was built parallel to and north of the mountains of the Caspian at Petrovsk, and this winter a line has been completed along the shore of the Caspian southward to a junction with the Trans-Caucasian Railroad near Baku, in the petroleum district, which now for the first time has an all-rail outlet. The new line has a strategical as well as a commercial importance, as it makes the Caspian accessible by troops at all seasons of the year.

The Prussian State Railroad management, at the beginning of this year, let heavy contracts for new rolling stock, including 763 locomotives, 826 passenger cars, 330 baggage cars, and 9,084 freight cars. At the same time it contracted with the syndicate of Rhenish-Westphalian coal miners for the delivery, during the year ending with June, 1901, of 2,511,000 tons of coal for locomotives at the rate of $2.40 per ton of 2,000 lbs. The contract price for the current year is $2.17 per ton, and for deliveries in competition with English coal, as low as $1.64 and $1.80.

American Practice in Block Signaling.*

By B. B. Adams.

IV.

SINGLE TRACK BLOCKING.

The block system is now largely used on single track railroads; and on all but a very few of the roads which thus use it, the plain "telegraph block" is the method employed. Although the space interval is as well adapted to single track as to double, and, under the same circumstances, as necessary on one as on the other, it was at first confined chiefly to double track lines; and the chapters preceding this one deal with double track practice (although the roads named have also introduced blocking on some of their single track lines).

One reason why double track lines were first "blocked" was the obvious one that such lines had the most frequent trains. The introduction of the block system was costly, because it required telegraph operators at many points where otherwise none would have been employed; and this was a more serious consideration 25 years ago than it is now, as competent telegraph operators were not at that time so easily found as now. Cost being such an important factor, only lines carrying a large traffic were thought of in connection with the improvement, and such lines were usually double-track. The cost might have been somewhat lessened by using electric bells, and a brief code, instead of the Morse telegraph, with its complete code, as new signalmen could learn the manipulation of the bells in a very short time, and places could be filled at smaller wages; but from a general disinclination to adopt English notions, or by reason of the cautious, not to say uncertain, spirit in which the block system was in most cases introduced, the use of bells was not considered until about 1888. (Though the New York Central used the Sykes apparatus on a few miles of road near New York. This may be considered an exceptional case). Again, the single-track roads, besides having a thinner traffic, felt more confidence in the methods which they already had in force. The train despatcher on a single track road is constantly arranging space intervals for trains running toward one another, and in doing this he can exercise direct supervision, in many cases, over the movements of trains following one another.

The first single track railroad in America which came prominently into notice as running trains under the block system was the Canadian Pacific, which

*Previous articles in this series may be found on pages 4, 34 and 84.

began using it in 1884. It is somewhat curious that while, on double track, blocking was first introduced on account of the increasing frequency of trains, this first single-track example should be on a line of pretty thin traffic. Quite likely the officers of the Canadian Pacific were influenced by English ideas more than was the case with their neighbors in the United States, and their English friends would, no doubt, advise the use of the space interval on all lines where the increased cost over the time interval was not great. With trains an hour or more behind one another, the block system is feasible, even with stations 20 miles apart; and where the general duties of the station agent are light he can maintain the space interval for such infrequent trains with little appreciable addition to his labors. It may be objected that if trains are an hour apart, that is just the place where the block system is least needed; but the fact that a road's trains are regularly kept separated by a long space interval, maintained by telegraph, has a value as an advertisement, and it is quite likely that the Canadian Pacific people fully appreciated this consideration.

It is also to be observed that in a cold country like that traversed by the Canadian Pacific, the exigencies of irregular traffic develop the need of the space interval sooner than in mild climates. In a genuine blizzard, with the mercury 40 degrees below zero, a flagman out a mile from his train, and perhaps five or ten miles from a house, is a poor protection against a collision.

Another consideration which, undoubtedly, may fairly be classed as having been an important factor in the argument for using the space interval on single track roads, is the quality of the discipline of the trainmen. A double track line, carrying large numbers of passengers, and seeking the highest safety for its passengers, would adopt the space interval regulations as a preventive of collisions; collisions from lack of block signals had not occurred, and the management simply strengthened the precautions by which they intended to make sure that collisions should not occur. But some single track lines, running only a few passenger trains but numerous freights, no doubt adopted the new plan as a cure. Collisions of freight trains were too frequent, and were costly, and the space interval was introduced specifically as a direct money saver. It was not, as with heavy passenger lines, a question of precautions for the safety of life and limb, and for the reputation of the road, so much as a question of expense. And this expense could fairly be charged, in large degree, to lack of discipline; for while some roads, particularly in the west, were putting in block signals because without them the freight trains persisted in running into each other, other roads, older and with more settled conditions as regards personnel, appear to have secured an equal degree of immunity from collision without the block system.

The significant fact in the matter now is that wherever the block system has been introduced it has been retained. While the discipline of the freight train men on some large roads ten or fifteen years ago was pretty bad, and Superintendents sometimes found it so difficult to improve the efficiency of their men that they were in a measure compelled to adopt costly expedients to make up for the weakness of the personnel, a great improvement has been effected. If the only reason for adopting the block system had been the difficulty of getting men to obey orders under the time-interval system, it is quite possible that in some cases there might have been by this time a disposition to restore the old plan. It is not so, however. Where the space interval is once adopted the Superintendents and other responsible officers feel such a greatly increased security that they value it more and more each year; and every successive increase in the number of trains running over the road gives additional force to the argument that the block system is necessary for celerity, to say nothing of safety. In the earlier years the Western roads had a poor system and poor personnel; then they had a good system and poor personnel, while now they have a good system and a good personnel.

Block Signaling on the C., M. & St. P.

One of the companies which has introduced the block system on a large mileage of single track line is the Chicago, Milwaukee & St. Paul; and as the officers of that company have recently made a careful recompilation of their regulations for working the system, a description of the practice of that road will afford the reader the best possible means of getting an insight into the general principles that govern on nearly all single track roads. These new rules are not radically different from those which preceded them, but this latest code embodies the results of the combined experience for ten years of all the Superintendents on the six thousand miles of the Milwaukee's lines.

The most fundamental difference between the block signal practice of single track roads (which are mostly in the West) and that of double track lines, like the Pennsylvania (which are mostly in the East), is that on the latter the old regulations for the prevention of collisions are practically abolished (or, at least, the new ones are made the chief dependence and the old rules become auxiliary), while on the former the block signal rules are secondary and the old rules retain their full force. The trainmen are indeed, directed, in both cases, to continue to observe the old regulations as to protecting delayed trains by red flags and torpedoes; but it is obvious to every one, brakemen included, that as regards trains moving in the same direction, which is always the case on a double track line, the block system makes the flagging unnecessary; while on single track the protection of a train from head-end or butting collisions is often effected by means of telegraphic orders sent by the train despatcher direct to the conductor and engineman of the train. This throws on these two men a direct responsibility in such specific shape that there is no shirking or evading it, and no chance to shift the responsibility on to other shoulders; so that here the men in charge of trains continue to perform their duties in the same manner as if no block system were in force. In conformity to this plan, a semaphore signal, on the Milwaukee road, does not tell an engineman that the road is clear for him to proceed to a certain place (the next station); it only tells him that, so far as is known by the block-signalman in charge of that signal, he may proceed. He is still bound to make sure, before proceeding, that there is ample time to reach the next side track (or place where trains can meet) before he will be required, by the provisions of the time table, or by orders which he has received by telegraph from the train despatcher, to surrender the right of way to some other train.

[TO BE CONTINUED.]

New Union Station at Dayton, O.

The Dayton Union Railroad is now building at Dayton, O., a union passenger station, the general appearance of which is shown in the accompanying sketch, Fig. 1. The main building is buff-colored brick with terra cotta trimmings. It is 53 ft. 9 in. wide by 215 ft. 4 in. long.

The sketches and drawings shown herewith have been sent to us by the architects, Messrs. Elzner & Anderson, of Cincinnati, who also furnish the following description:

There are three umbrella sheds as shown, accommodating the five passenger tracks. The middle shed is 1,000 ft. in length from Ludlow Street to Perry Street. All three are connected across the center by a transverse covered way, which is on a line with Wilkinson Street, this being an approach from the north; Ludlow Street is the main approach from the east. Wilkinson Street, however, will be used principally as the carriage approach, as well as for all baggage and transfer traffic. From Wilkinson Street west, extending along the tracks, there is a one-story building, called the Annex, which contains the baggage, mail and express rooms and the power plant. The space east of Wilkinson Street extending toward Ludlow Street, is occupied by the main building, containing the general waiting room, with the usual adjuncts of ladies' room, smoking room, lunch and dining rooms, and ticket office, etc. There are offices on the second floor. The general waiting room occupies the greater part of the space in the center of the building. It has approaching corridors from Wilkinson Street and from Ludlow Street, and is equally accessible from either direction.

The main building is placed about one hundred

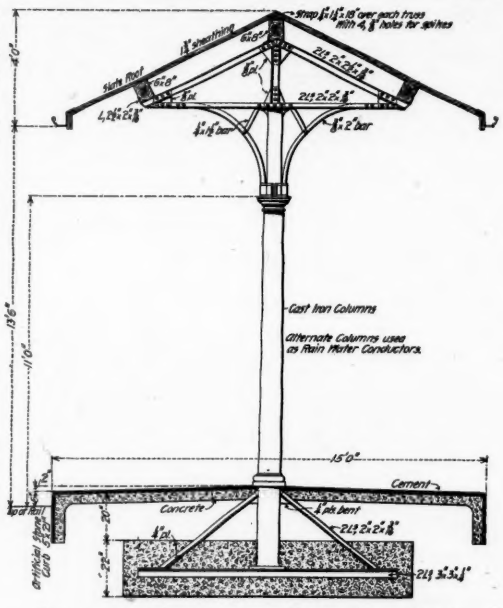


Fig. 4.—Shed Over Platform—Dayton Union Station.

feet back from Ludlow Street, the intermediate space being a court, which is approached through a monumental entrance on the line of Ludlow Street. This entrance is a structure 20 ft. wide and 100 ft. long and about 30 ft. high, consisting of a square arched pavilion at each end, connected by a double colonnade, the pavilions serving as entrances and exits for pedestrians, and the colonnade for vehicles. The center portion is occupied by a bronze drinking fountain. This structure is called the propylon and is made of stone columns and arches, with terra cotta cornice and red tile roof.

The main building is constructed of mottled warm buff-color pressed brick, with terra cotta trimmings and a red tile roof. The clock tower at the corner rises to a height of 136 ft., being surmounted by a stone arcade and projecting balconies.

The entire main floor of the building is covered with mosaic tiling of elaborate design, and the walls of the general waiting room and corridors are wain-

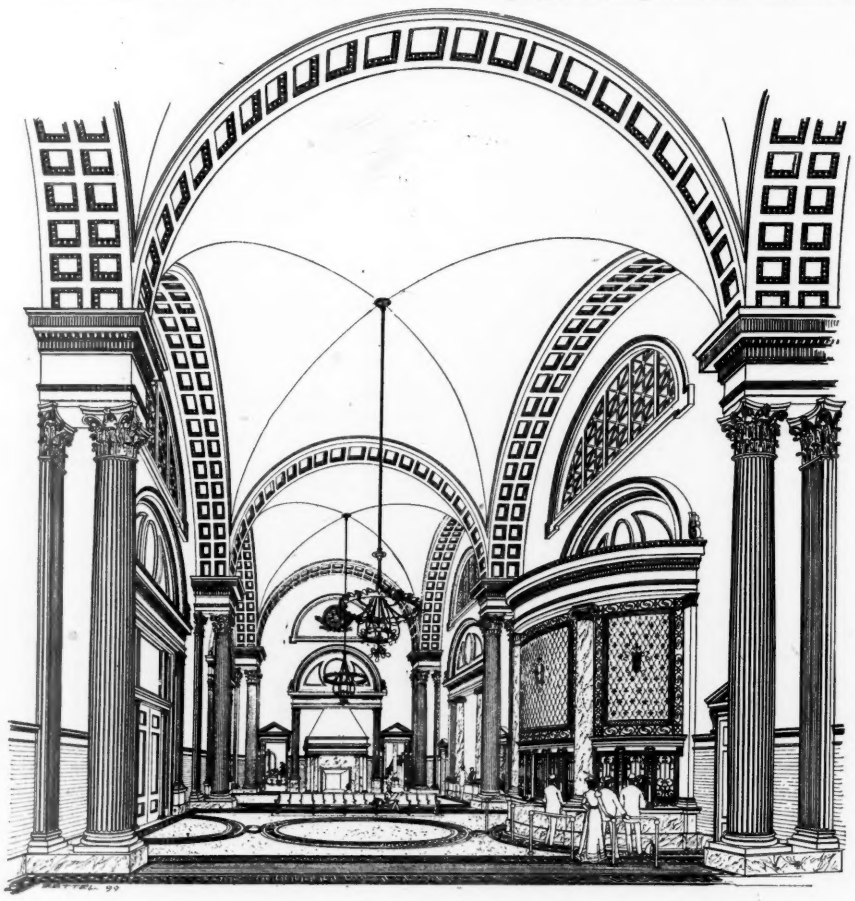


Fig. 3.—Dayton Union Station—Main Waiting Room, Looking West.

scoted with glazed tiles of a rich, deep-green color, 7 ft. high.

The general waiting room is 41 ft. by 110 ft. and 45 ft. high. It is divided into three square bays in its length; each bay having a groined vaulted ceiling resting upon large detached Corinthian columns, ar-

ranged around the room. From each of the three bays, doors lead to the covered platforms or train shed, while on the other side, opposite to these entrances, there are large arched openings, one in each bay, behind which are arranged the offices. The ticket office is in the center, with a circular bay projecting out into the room; the check room is on the left, and the news stand and telegraph office are on the right. These large openings are decorated with marble columns, and the ticket office is enclosed by an elaborate iron grille, filling in the space between the columns.

All interior woodwork will be of natural oak; but in the general waiting room the columns, pilasters

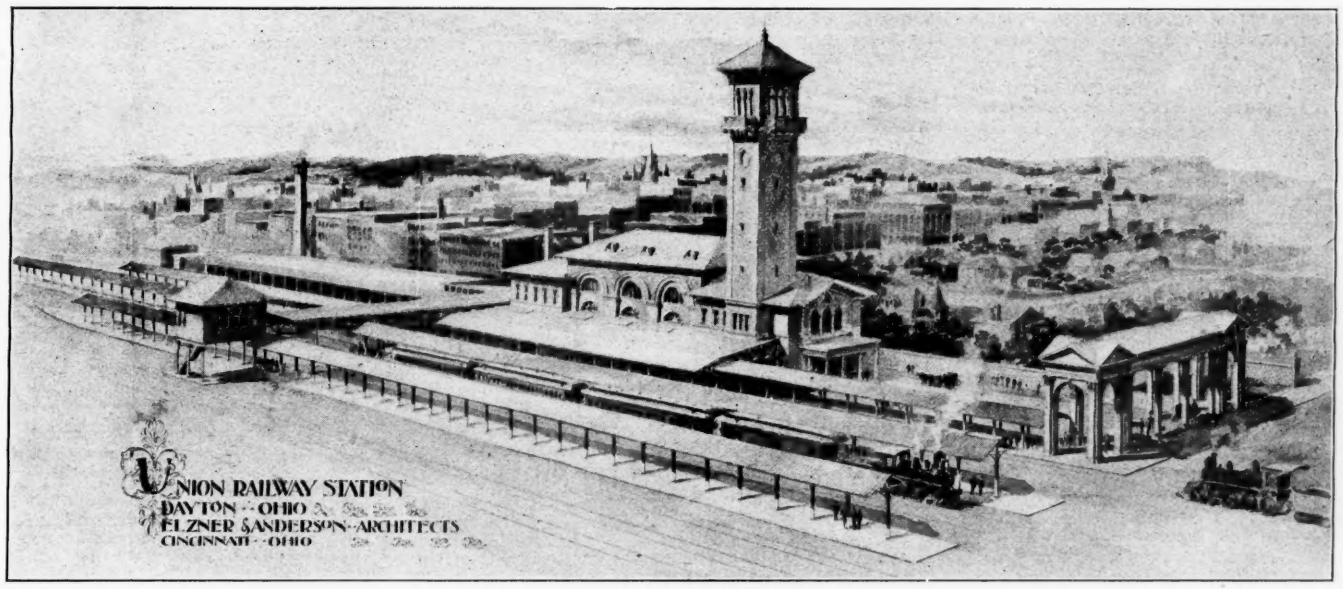


Fig. 1.—Union Passenger Station at Dayton, Ohio.

and cornice, together with the paneled and moulded arches, will be white work. This forms a striking contrast and emphasizes the architecture against the color scheme on the walls and ceilings.

The entire building is treated both internally and externally in the style of the Italian rennaissance, and the marked feature of the external architecture of the main building consists of large brick arches, 28 ft. in diameter, marking the groined ceilings in the bays of the main waiting room, which occupies the full height of the building. In these arches are circular windows to light this room above the shed roofs.

In the design of the umbrella sheds, Fig. 4, the supports are made of cylindrical cast iron columns, extending into the ground about three feet, and attached at the foot to an iron cross arm made with double angle iron, about 10 ft. long, the ends of which are connected with the column by diagonal knee bracing, all of which bracing is underground and embedded in a bed of concrete 1½ ft. wide. The columns above the ground are ornamented with a moulded cast iron base and cap. Wooden purlins are used, but only three are required. These are supported on light iron brace arms attached to the cast iron column, the braces in each direction being curved, so as to be more graceful in design than the usual straight brace. Rafters are entirely dispensed with, and in lieu thereof tongued and grooved

The buildings and power plant will be completed at a cost of something over $150,000. All the work, with the exception of the power plant, was let by general contract to S. W. Hornbrook, of Cincinnati, the power plant itself having been divided into various contracts directly with the manufacturers above mentioned.

The Dayton Union Railway, the owner of this station, is controlled by the Cleveland, Cincinnati, Chicago & St. Louis, the Pittsburgh, Cincinnati, Chicago & St. Louis, the Cincinnati, Hamilton & Dayton and the Dayton & Union. These are the roads which will use the station. It is expected that the building will be finished about May 1.

Concerning Certain Rubbish.

A soldier was once assigned to walk a beat at a castle, in England, beneath the window of a room where Queen Elizabeth slept. When the Queen departed the sentry was forgotten, but one sentinel after another continued to walk under that window for three hundred years. So the story goes.

A clerk in a passenger department used to wonder why suburban patrons of the road who had not obtained commutation tickets by the fifth of a month were required to get an order on the local agent from the general passenger office before they could buy

ment that it never had made any such requirement, that the orders were not turned in to it, that it did not care on what day a man bought a monthly ticket, that the conductors in any event would not honor it after the expiration of the calendar month.

A clerk who had been in the employ of the company for a generation, happening to hear the discussion, then explained that when the suburban traffic had begun, twenty-five years before, there were but one or two suburban trains each way a day; the monthly tickets were not punched by the conductor each trip but read good between the terminal and a suburban station for a specified month. The conductors knew all of the commuters, and that the passengers might not be bothered by having to show their tickets each trip, a list was printed by the passenger department on the fifth of each month containing the names of commuters who had bought tickets, and their stations, and a copy was furnished to each conductor. Therefore anyone who had not bought a ticket by the fifth was required to go to the general passenger office that his name might be given the conductors. This requirement had lived a score of years after the reason for it had ceased.

An alert general manager of a great railroad system began an examination two or three years ago of the routine methods of his department, of the various blanks and the procedure connected with

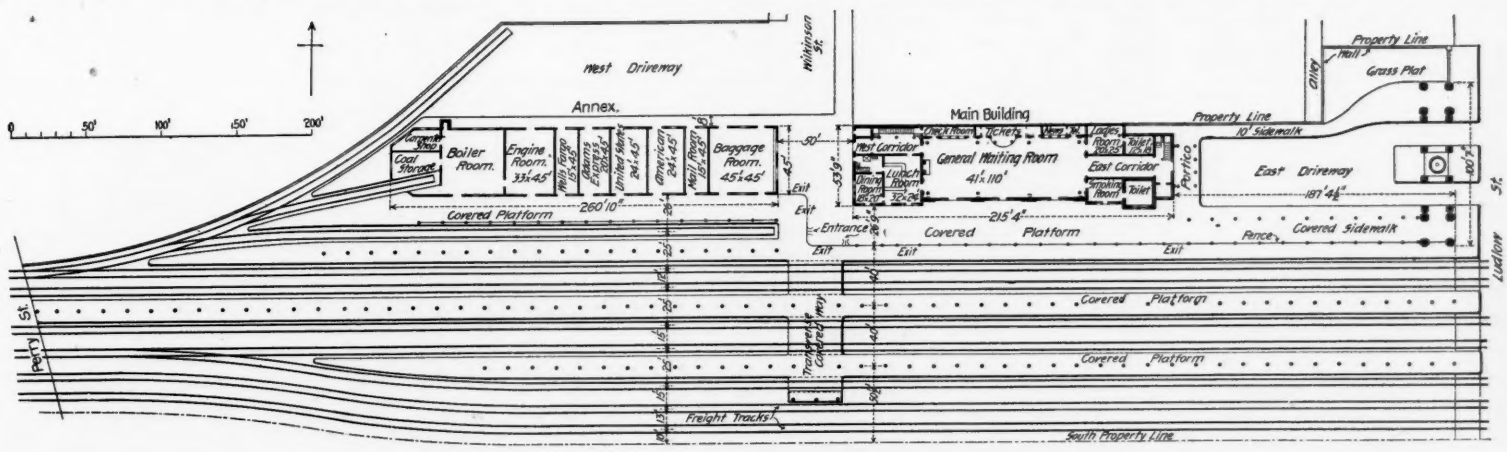


Fig. 2.—Dayton Union Passenger Station—Plan of Buildings, Approaches and Platforms.

sheathing boards 1¾ in. thick are laid across the purlins in single lengths of 8 ft. from the ridge to the eaves, having a span of 5 ft. between the purlins and an overhang of 3 ft.

The roof slates are laid directly upon the sheathing, which is dressed and varnished on the underside. Hanging gutters are used and these are drained through copper conductors, which extend horizontally toward the column with which they are connected, the column acting as a rain water con-

tickets. The rule was not in effect at other large cities on the line. It seemed as if a passenger, if prevented by sickness or absence from buying a ticket at the beginning of a month, might be trusted to calculate whether it was to his advantage to buy a monthly ticket at a later date or round trip tickets each day. The chief clerk of the department silenced an inquiry by the statement that the order was required by the accounting department.

In the course of time the clerk ventured to address

them. He discovered a vast amount of unnecessary work being done, partly because of customs that had continued after the reason for them had died, partly because methods that had sufficed under simple conditions had become involved and burdensome with increase in the volume of traffic and variations in its incidence and direction. Thousands of dollars a year were saved to his company by the adoption of simpler and better methods and results were more effectively and more speedily attained.

TECHNICAL.

Manufacturing and Business.

The Powers Regulator Co., Chicago, has recently equipped one train of the Pennsylvania Limited and two trains of the Chicago & Northwestern Limited with its automatic regulators for controlling the temperature of the cars.

The Simplex Railway Appliance Co. will furnish the body and truck bolsters for the 2,000 coal cars recently ordered by the Hocking Valley and noted in our issues of Feb. 9 and 16.

Julian L. Yale has been elected Second Vice-President of the Simplex Railway Appliance Co. of Chicago. J. L. Yale, T. V. Church and R. C. Hallett, composing the firm of Julian L. Yale & Co., will represent the interests of the company in the sales department.

The Michigan Lubricator Co. has during the past two years made three large additions to its capacity. The company now informs us that in order to meet the increasing orders for locomotive lubricators it is now making a fourth increase and adding new tools.

The Chicago Pneumatic Tool Co. reports it is impossible to keep up with the orders for its various pneumatic appliances, working day and night in all its factories. The foreign business also is reported as increasing.

The Harrison Dust Guard Co. of Toledo, Ohio, this week shipped several thousand dust guards to the Southern Car & Foundry Co.; also dust guards for 1,000 cars, to the American Car & Foundry Co., as well as filling other orders for repairs, for different roads.

At the annual meeting of The United States Metallic Packing Co., held in the company's offices in Philadelphia, the following were elected directors: John Reilly, Charles Longstreth, Godfrey Rebman, Robert K. Cassatt and Rudolph Ellis. Mr. Reilly was elected President and Treasurer; Mr. Longstreth Vice-President, and Ellis Curtiss, Secretary. The annual statement presented was the most satisfactory in the history of the company.

The Boston Elevated has just placed an order with the American Wood Preserving Co., of Philadelphia, for 4,000 gallons of the wood preservative "Woodline." The Boston Elevated commenced using this compound about February, 1897, treating the crossties for the Boston Subway, as well as using it for other purposes.

The Buda Foundry & Manufacturing Company, Chicago, has bought the entire crossing gate business of the Bogue & Mills Manufacturing Company and all pneumatic or mechanical gates hereafter furnished will be in accordance with the Bogue & Mills patents. For several years the Buda Company has made all the parts used in the Bogue & Mills gates and is well fitted to assume the business, having retained the employes of the old company. The Buda Company will also carry a complete stock of repair parts for gates.

Iron and Steel.

The Carnegie Steel Co., Ltd., is now furnishing the Pressed Steel Car Co. with 1,200 tons of plates daily, and it is understood that the amount will be increased to 1,600 tons before long, as the car company expects to increase the car production from 125 to 140 cars a day. About 12 tons of plates and other shapes are used in each car.

Another improvement is announced for the Duquesne mills of the Carnegie Steel Co., Ltd. A billet mill of large size will be built. The plans are not finished. At Rankin the foundations for the two new furnaces are about completed, and the structural work of one of the furnaces is under way.

S. W. Vaughen, of Coopersdale, Pa., heretofore superintendent of the Cambria Steel Co.'s blast furnaces, has resigned to become Superintendent of the Lorain Steel Co.

Frank Gallagher, at one time Superintendent of the Cambria Steel Co.'s structural department, has been made Superintendent of the Walker plant of the Shiffler Bridge Co. at Homestead, Pa.

The Tredegar-Brown Ore & Mining Co. has been organized in Anniston, Ala., with $100,000 capital. J. W. Comer of Savannah is President and Treasurer, and H. H. Comos of Anniston is Vice-President and General Manager. The company has bought ore properties near Jacksonville, Ala.

A New Shipbuilding Company.

The Norfolk Shipbuilding & Dry Dock Co., of Norfolk, Va., has been incorporated with a capital of $500,000. J. P. Andre Motter is the President and H. W. Anderson, of Exeter, Mass., Vice-President and General Manager. The company purposes to build a shipbuilding plant and establish a large dry dock at Norfolk.

The Proposed Sheet Mill Consolidation.

Again it is reported that options have been secured on about two-thirds of the sheet mills in the United States for consolidation. Four concerns, operating 55 mills, are said to have not given options. They are: Zug & Co., Pittsburg; Apollo Iron & Steel Co., Vandergrift, Pa.; W. Dewees Wood Co., McKeesport, Pa., Whitaker Iron Co., Wheeling, W. Va. The new company will be capitalized at $52,000,000, half of which is to be in common and the rest preferred stock. Judge W. H. Moore and his brother James H. Moore, of Chicago, are the promoters.

It is announced that the same syndicate which controls the National Steel Co., the American Steel Hoop Co. and the American Tin Plate Co. have a controlling interest in the American Sheet Steel Co., and that the four companies are to be consolidated.

Rapid Transit in New York City

The Rapid Transit Subway Construction Co. of New York was incorporated at Albany, Feb. 9, to build and equip rapid transit railroads in New York City. This is the construction company of John B. McDonald, who has obtained the contract for the Rapid Transit underground road in New York City. The capital stock is $6,000,000, all common, the shares being $100 each. The Directors for the first year are: William H. Baldwin, Jr., Charles T. Barney, August Belmont, George Coppell, E. Mora Davison, James Jourdan, Gadiner M. Lane, Walter G. Oakman, John Peirce, Wm. A. Read, Cornelius Vanderbilt and Geo. W. Young. These men, with the exception of Mr. Lane of Cambridge, Mass., are residents of Brooklyn or New York, and are kell known in railroad and financial circles. A notable feature of the construction company is that no less than four men, Messrs. Baldwin, Belmont, Oakman and Young, are directors of the Long Island RR. On Monday aditional time was given to Mr. McDonald to qualify in his bonds, and to sign the contract, the understanding being that arrangements will be completed on Saturday of this week. Mr. McDonald will then be ready to sublet contracts for building the different sections of the tunnel. According to the terms of the bid building must be begun within 30 days from the signing of the contract.

Cleaning of Passenger Equipment Cars.

At the last convention of the Master Car Painters' Association considerable discussion was raised as a result of reports on the subject of cleaning passenger equipment. There seems to have been for many years a desire to find some effective and safe material that could be put into the hands of ordinary laborers, and used for the effective cleaning of the varnished surfaces of railroad cars, both outside and inside. At the convention above referred to a material was spoken of by one of the members which was entirely new to most, if not all, of the railroad representatives present. This material, "Ko-Ko Cream," is now put upon the market by the "Ko-Ko Cream Company," of New York. This material has been subjected to practical tests for nearly two years and we are told that cars which have been thoroughly cleaned with it at intervals of about three months have shown no deterioration of varnish due to the cleaner. Tests have been made with this material by pouring it on the top of a desk which was finely varnished and allowing it to remain undisturbed for a number of hours. Upon wiping off the material, the closest scrutiny, even with a glass, failed to shown any sign of injurious effect. In fact, after the material was wiped off the surface was brighter than before. Pieces of glass coated with varnish and dried have been submerged in this material for twelve hours without in any way affecting the surface or appearance of the varnish.

"Ko-Ko Cream" possesses another desirable quality, namely, the readiness with which the dirt is loosened and removed from the surface.

THE SCRAP HEAP.

Notes.

The Supreme Court of Kansas, in the case of A. T. & S. F. against Campbell, has declared unconstitutional the law passed by the Populist legislature of 1897 requiring every railroad to furnish free transportation, going and coming, for a man with every shipment of live stock.

Vice-President John M. Egan, of the Central of Georgia, has lately issued his third pamphlet containing "Facts for the Farmers" along the lines of his road. Of the first pamphlet 30,000 copies were printed. In this last issue Mr. Egan describes the work of agricultural experiment stations, especially in connection with fertilizers. He also discusses pure water and how to obtain it; and skimmed milk and what it may be used for.

A passenger train of the New Mexico & Arizona road was held up by robbers at a station 18 miles south of Benson on the night of Feb. 15. Express messenger J. D. Milton, although surprised just as he opened the door to pass out his packages at the station, opened fire on the robbers and vanquished them, but the messenger was wounded. The robbers escaped, but one of them was found the next day in a dying condition, having been wounded by a ball from Milton's pistol.

To Close Drawbridges in New Jersey.

Last week petitions were passed through the passenger cars by the conductors of the Delaware, Lackawanna & Western for the signatures of commutors, requesting the Secretary of War to allow the drawbridges over the Hackensack and Passaic rivers, to be closed to river traffic between the hours of 7 and 10 a. m. and 4 an 6 p. m. Similar petitions were signed by pasengers on the Erie, the Pennsylvania and the Central of New Jersey. The opening of these bridges during the hours mentioned delays heavy suburban passenger trains, while on the other hand the merchants of Newark and other places along the rivers, and the river transportations companies, are opposed to closing the bridges for any definite time, as it would make costly delays in river traffic.

Traffic Notes.

The railroads of the Central Passenger Association have decided to make a rate of one cent a mile each way from all points to Chicago for the Grand Army of the Republic next August.

Chicago dispatches indicate that eastbound rates on grain continue demoralized and that there is also secret cutting on provisions. The Illinois Central has announced a reduction (to 12 cents) in the rate on corn for export from all points in Illinois to New Orleans, the avowed purpose being to meet the competition of the lines leading to the Atlantic Seaboard, which competition the Illinois Central is said to have felt for the last four months. The present announcement will, no doubt, be followed by reductions from Kansas points to Galveston. Through shipments of flour, grain and provisions from Chicargo eastbound for the week ending Feb. 8 amounted to 154,806 tons, a very heavy movement. This is taken to indicate that rates were very low and that an increase was expected; but meetings of traffic officers to discuss an advance in the rates appear to reach no definite results.

The Southern Classification Committee has held a meeting lasting several days to consider the complaints of shippers at New York and elsewhere concernings recent advances in freight rates. The reporters say that most of the requsts made by the shippers have been granted. The Committee has decided in favor of adopting a uniform bill of lading substantially similar to that used by the Trunk Line Association and which, like that of the Trunk Line Association, will provide for an increase of 20 per cent. in the rate on shipments which are classed to go at owners' risk, but which the shipper requires to be carried at the carrier's risk. This is a reduction of one-third from the 30 per cent. difference which was announced when the new classification was published about a month ago. It does not appear that this difference as between C. R. and O. R. prices had been proposed by the railroads, except in connection with those commodities which always have been subject to a difference of this kind.

The Depth of the St. Lawrence River.

The reason why railroads which carry export grain to Boston, New York, Baltimore, etc., have not been more exercised over the reports concerning the improvement of the water route to Montreal is, to a large degree, explained, if not made wholly clear, by a statement reported by the newspapers from Montreal concerning the shallow places in the channel of the St. Lawrence River. While the canals and the locks have been enlarged so as to permit the passage of vessels drawing 14 ft. of water, the river itself must yet be widened and deepened at many places before it will be safe for vessels large enough to utilize the canals to their full capacity. Starting out with a reminder that Mr. Connors and his Buffalo capitalists will not have a chance to start their cheap transportation scheme during the present year, the reporter goes on to give particulars concerning the condition of the river. "In the tunnel between Rapide Plat and St. Regis at no less than seven places there are serious obstructions in the shape of shoots, narrow and tortuous channels, boulders and swift and dangerous currents. There are, moreover, several obstructions to navigation not marked upon the charts.

"The question of lights is a serious one. It is said that the United States Government fixed eighty gas buoys last year, to half a dozen put in by the Canadian Government. The Canadian side of the stream is badly lighted compared with the United States side. In some parts of the channel lights are needed at every turn, and there are said to be fifty miles of the channel, between Prescott and Montreal, which it would be inadvisable to navigate at night with boats drawing fourteen feet, or even twelve feet. From Kingston to Prescott the channel is not safe at all at night on the Canadian side, and the United States side must be used. The channel, too, is less than fourteen feet deep in places on the Canadian side and is, therefore, impracticable.

"The channel will probably have to be widened from 300 ft. to 500 ft. at places where there are cross-currents and bends. A steamer with two consorts under the future conditions will represent 765 ft. of vessel, and with the tows 200 ft. apart the space covered will be about 1,265 ft."

Last Wooden Bridge on the Southern Pacific.

The bridge over the American River near Sacramento, Cal., on the Southern Pacific, is in process of reconstruction; it consists of seven spans of 100 ft. each with creosoted trestle-work approaches. This is the last wooden bridge on the main line between Sacramento and Ogden, all the others having gradually been replaced with metal structures.

Technical Schools.

University of Wisconsin.—Mr. H. G. Prout, Editor of the Railroad Gazette, lectured at the University Feb. 16 on "The Engineers and the Railroads." The following lectures have been arranged for this spring:

"The Manufacture of Portland Cement," February 23. R. C. Carpenter, M. M. E., Prof. of Experimental Engineering at Cornell University.

Illustrated Lecture on "Mexico," March 2. W. J. Karner, Asst. to Chief Engr. Ill. Central Ry., Chicago.

"The Chemical Engineer," March 9. Magnus Swenson, M. S., Manufacturer, Chicago.

"The Water Supply of Rockford, Illinois," March 16. D. W. Mead, C. E., Consulting Engineer.

"The Government Work in the St. Paul District," March 23. A. O. Powell, C. E., U. S. Asst. Engineer.

"Three-phase Railway Work," April 6. W. B. Potter, E. E., Engr. Ry. Dept. Gen. Elec. Co., Schenectady, N. Y.

"Mechanical Ventilation and Heating," April 20. W. B. Snow, M. E., of the B. F. Sturtevant Co., Boston.

"Some Recent Economic Events," April 27. George B. Leighton, Pres. Los Angeles Terminal Ry., St. Louis, Mo.

Railroad Building in the Straits Settlement.

Arrangements are being made by Sir F. A. Swettenham, the Resident General of the Federated Malay States at Kuala Lumpur in Selangor, for connecting Singapore with Penang. There is a line already to Seremban, and this is to be extended 56

miles to the Muar River. Thence the road will run the entire length of the Johore State to Johore Bahru, 120 miles. This brings the line to the Kranji Strait, which is to be crossed to Kranji by steam ferries and thence 14 miles to Singapore by the proposed Singapore Colonial line. The entire road, including buildings, is estimated at $30,000 per mile, or $1,680,000 for the Federated Malaya; $3,600,000 for Johore and $498,796 for Singapore. The line will extend the entire length of the Malay Peninsula. Surveys are to be made immediately and building will be begun before 1902.

Iron Works to Consolidate.

A plan to consolidate the iron mines of the Troy Steel Co., Witherbee, Sherman & Co., of Mineville, N. Y., and the Cullen Brothers & Lewis Steel Co., is under way. The consolidated company, which is expected to have a capital of $17,000,000, is to be financed, it is said, by J. P. Morgan & Co. The Troy Steel Co. owns the Albany Iron Works, the Renssalaer Iron Works and the Bessemer Steel Works. The Albany Iron Works were established in 1819. They have 23 heating furnaces, seven trains of rolls, four steam and two trip hammers, and two bolt, eight rivet and two nut machines. The annual capacity is 50,000 gross tons. The Rensselaer Iron Works were built in 1846. They have 18 heating furnaces and four trains of rolls. The annual capacity is 25,000 gross tons. The Bessemer Steel Works were built at Troy in 1864, but in 1896 were removed to Breaker Island, opposite Troy, and enlarged. With 15 gross ton basic converters, four cupolas, four Spiegel cupolas, two five-hold Hainsworth pit furnaces, and 24 soaking pits, the annual capacity is 200,000 gross tons of ingots. Connected with these steel works is a rolling mills with an annual capacity of 200,000 gross tons. Witherbee, Sherman & Co. own extensive ore lands at Mineville and Port Henry, N. Y. The Cullen Brothers & Lewis Steel Co. was incorporated in New Jersey about two years ago, with a capital stock of $500,000. The Port Henry and Mineville property has produced 500,000 tons of ore a year, and includes a railroad from Mineville to Lake Champlain. When the proposed consolidation is complete it is proposed to enlarge and newly equip the works on Breaker Island, which are now idle, adding to them a gas plant to supply Troy with gas.

New York Dock Contracts.

The New York City Dock Board let contracts Feb. 16 for building a new wooden pier with appurtenances east of Pike Slip, East River, and for furnishing 10,000 barrels of Portland cement. The bidders for the pier were: Seaboard Contracting Co., $36,917; Wm. H. Jenks, $34,892, who was given the contract; Henry L. Spearin, $39,225, and Wm. T. Ritch, $37,266. The cement bidders were: J. Early's Sons, $1.89½ per barrel; Sparrow, Fredenberg & Co., $1.91; John P. Kane Co., $2.00, and Manhattan Supply Co., $2.44.4. The contract was awarded to J. Early's Sons.

Changes in Lake Levels.

Representatives of the Lake Carriers' Association appeared last week before the House Committee on Rivers and Harbors to urge the appointment of a joint committee by the governments of the United States and Canada to consider the effect on lake levels of the Chicago Drainage Canal and of the proposed Sault Ste. Marie power canal. The latter canal is to be completed early in 1901. The same committee on Feb. 14 gave a hearing on the proposition to build a regulating dam at the foot of Lake Erie to control the lake levels. The dam and lock below it would cost $2,800,000. Major Symons, in charge of the engineering work in that locality, favored the appointment of a commission of eminent experts to thoroughly investigate the proposition.

At Chicago a chart has been prepared and data collected by the Commissioner of Health and the Sanitary District showing that from 1871 to 1898 the lake levels have ranged from 52 in. above datum to 43 in. below datum, or almost 8 ft., and also that during the last year the rain-fall over the lake regions was more than 5 in. below the average for the last 29 years. From this it is concluded that a low level is to be expected this year, which will not be due to the drainage canal, but to natural causes.

Electric Railway Bids Wanted for Durban.

American electric railroad contractors should note that the Durban (Natal) Corporation is inviting tenders in England for various works connected with its proposed street railroads. The latest date for sending tenders to the Town Clerk at Durban is Monday, April 2. Specifications may be secured for a £10 10s. deposit, from the corporation's London agents, Messrs. Webster, Steel & Co., 5 East India avenue, London, E.C. The works include 1,900 tons of steel girder rails, 64 tons of fish plates (with necessary bolts, nuts, tie bars and electric bonds), and 407 loads of Australian hardwood stringers (dog spikes, etc.). The contractor will have to lay the above, comprising 14.36 miles of single track and bond 2.96 miles of existing single track, the town authority laying the concrete foundations and making up the roadway.

The Frick-Carnegie Suit.

Henry Clay Frick, until Dec. 4, 1899, Chairman of the Directors of the Carnegie Steel Co., Ltd., has begun suit in the Court of Common Pleas, at Pittsburgh, against Andrew Carnegie and the Carnegie Steel Co., Ltd., asking the court to annul the recent action of the company in transferring his interests and to declare him (Frick) still a member of the firm; and in case of refusal to appoint a receiver to the end that Frick may have his rights, and his share in the management.

Mr. Frick estimates the value of his interest in the company at $16,238,000. He states that Mr. Carnegie has taken steps to acquire this interest at a price not exceeding $6,000,000. It is stated that Mr. Carnegie values the entire property of the company at $250,000,000 and believes that he could sell it in London for $500,000,000. Mr. Frick states that the profits of the business in 1899 were $21,000,000 and that Mr. Carnegie estimated that the profits for 1900 would be $40,000,000. Mr. Frick estimates that this year's profits will be $42,500,000. Mr. Carnegie is the largest shareholder, owing 58½ per cent. of the stock. Mr. Frick is third on the list, owning 6 per cent.

Examinations for Automobile Operators.

At Chicago a Board of Examiners, of which City Electrician Ellicott is Chairman, has prepared a list of 18 questions which operators of automobiles will be required to answer when examined. Regular examinations will be required, and the police will be instructed to enforce the ordinance. The medical examination will require good eyesight, sound hearing and a nervous system sufficiently stable to enable operators to exercise ordinary common sense in emergencies or under excitement. The following is the list of technical questions approved by the Board:

1. What is the character of power used to propel the vehicle you wish to operate?
2. What is the approximate weight of the vehicle?
3. How many persons is it designed to carry?
4. Is it to be used for private, public or business purposes?
5. What speed is it capable of making on ordinary streets in Chicago?
6. Do you understand the law and responsibility which govern operating a vehicle on the public streets?
7. What experience have you had in operating a vehicle of the class you now wish to operate?
8. Has an accident ever been caused by the vehicle you were operating? If so, state the circumstances.
9. If the vehicle you wish to operate is traveling at the speed allowed by the ordinance, in how short a distance could you stop it?
10. What precautions would you take when approaching a crowded crossing?
11. What parts of the vehicle do you consider should be carefully and frequently inspected?
12. What precautions would you take when leaving the vehicle on the street without an attendant?
13. State how you would start the vehicle.
14. State how you would make an emergency stop.
15. How is the brake applied to the vehicle?
16. How would you reverse direction or cause the vehicle to go backward?
17. By what means can you tell when the supply of power for the vehicle is nearly exhausted?
18. Do you agree that in event of an accident in which the vehicle you are operating is concerned you will report the circumstances in writing to the board of examiners within twenty-four hours of the occurrence?

Philadelphia Commercial Museum.

A bill has been introduced into the House of Representatives by Mr. Bingham and referred to the Committee on Interstate and Foreign Commerce providing for adding to the specimens gathered in the Philadelphia Commercial Museum. The bill carries an appropriation of $200,000 for this purpose. It is House Bill No. 887 and Senate Bill No. 417. Those who are interested in the passage of this bill should inform their Members of Congress.

A Proposed Railroad in New Caledonia.

A railroad is to be built on this island from Nounea, capital of Bounea, to a seaport town about 90 miles northwest. Large graving docks will be built at Nounea. The French Government will guarantee a loan of 10,000,000 francs and the work will be in charge of the Minister of Colonies at Paris.

LOCOMOTIVE BUILDING.

The Ulster & Delaware is in the market for six locomotives.

The Standard Oil Co. is having one engine built by the Brooks Locomotive Works.

The Central of Brazil is having six engines built by the Baldwin Locomotive Works.

The Tionesta Valley recently ordered one engine from the Brooks Locomotive Works.

The David Wood Lumber Co. has ordered one engine from the Brooks Locomotive Works.

The Coahuila & Pacific has ordered two engines from the Cooke Locomotive & Machine Works.

The Maine Central has ordered four more engines, two moguls and two switchers, from the Schenectady Locomotive Works.

The White Pass & Yukon has issued specifications for two narrow-gage 10-wheel locomotives, with 16 in. x 20 in. cylinders.

The Chicago Great Western order for 16 locomotives, referred to Feb. 9, will be placed shortly. The bids were received Feb. 20.

The National of Tehuantepec contemplates ordering before July next at least four locomotives, to weigh 50 tons each, exclusive of tenders.

The Baltimore & Lehigh is about to order six locomotives. The order will probably be given to the Richmond Locomotive & Machine Works.

The Chicago & Alton is said to be preparing specifications for some freight locomotives to be heavier than those recently received by the Illinois Central.

The Colorado Fuel & Iron Co. has ordered five engines from the Baldwin Locomotive Works. Probably these are for the Crystal River Railroad, referred to Jan. 26.

The International & Great Northern has ordered from the Rogers Locomotive Co. three 10-wheel freight engines with 20 in. x 28 in. cylinders and 62 in. driving wheels, to weigh 166,000 lbs.

The St. Louis Southwestern has ordered from the Rogers Locomotive Co. seven eight-wheel passenger engines, to weigh about 117,000 lbs. They will have 18 in. x 26 in. cylinders and 68 in. driving wheels.

The Texas & Pacific has ordered from the Rogers Locomotive Co., for August and September delivery, three pasenger and seven freight engines. The former will weigh 156,000 lbs. and have 19 in. x 26 in. cylinders and 67 in. driving wheels; the latter will weigh the same as the passenger engines and have 20 in. x 26 in. cylinders and 63 in. driving wheels.

The Denver & Rio Grande has ordered from the Baldwin Locomotive Works the 15 consolidation locomotives mentioned last week. They are for September delivery and will have cylinders 22 in. x 23 in. and will weigh, without tenders, 190,000 lbs., of which 168,000 lbs. will be on the driving wheels. The driving wheels will measure 54 in. in diam. and the tender capacity will be 6,000 gals. of water and 10 tons of coal.

The Pittsburgh, Bessemer & Lake Erie is having built five new locomotives. Two will be heavy freight locomotives, ordered from the Pittsburgh Locomotive & Car Works, for use on hills, and will have 23 in. x 32 in. cylinders and weigh 218,000 lbs. on drivers. Two will be six-wheel switching locomotives, with 19 in. x 26 in. cylinders, ordered from the Brooks Locomotive Works. One consolidation locomotive, with 22 in. x 28 in. cylinders has been ordered from the Baldwin Locomotive Works.

The Georgia Southern & Florida, as stated last week, has ordered one passenger and three freight locomotives from the Schenectady Locomotive Works. The former will be of the eight-wheel type and weigh 133,000 lbs., with 85,000 lbs. on the driving wheels and have 19 in. x 26 in. cylinders; 69 in. driving wheels; extended wagon top type boilers with radial stays and 320 charcoal iron tubes 2 in. in diam. and 13 ft. long; fireboxes, steel, 102 in. long and 40⅜ in. wide; heating surface, firebox, 174 sq. ft., tubes, 2,168 sq. ft.; grate area, 30 3/10 sq. ft., and tender capacity, 4,500 gals. of water and eight tons of coal. The freight engines will be 10-wheelers, weigh 148,000 lbs., with 118,000 lbs. on the driving wheels and have 20 in. x 26 in. cylinders; 56 in. driving wheels; heating surface, firebox, 168 sq. ft., tubes, 2,332 sq. ft.; and grate area, 28.6 sq. ft. In other respects the dimensions are the same as for the passenger engines except that the tubes will be 13 ft. 10 in. long. All of the engines will be equipped with Westinghouse brakes; steel axles and springs cast iron brake shoes and tender wheels, Gould and Janney couplers, electric headlights, Sellers injectors, U. S. metallic piston and valve rod packing, Coale muffled safety valves, Leach sanding devices, Nathan lubricators and Latrobe driving wheel and Standard truck wheel tires.

CAR BUILDING.

The Mexican is considering ordering 100 coal cars.

The Chihuahua & Pacific is about to order 15 box cars.

The Chicago, Burlington & Quincy is in the market for six passenger cars.

The Chicago Great Western has issued specifications for the 1,000 cars noted Feb. 9.

The National of Tehuantepec expects to order some freight cars shortly after July 1 next.

The Vandalia has ordered 300 of the coal cars referred to Feb. 9 from the American Car & Foundry Co.

The New York, New Haven & Hartford denies the report that it will build 100 freight cars at its East Hartford shops.

The Terminal Railroad Association of St. Louis has ordered three passenger cars from the American Car & Foundry Co.

The Little Rock & Hot Springs Western has ordered one combination car and four coaches from the American Car & Foundry Co.

The Chicago & Eastern Illinois has dropped the matter of ordering 500 steel cars. Reference to this proposed order was made Jan. 19.

The Pacific & Idaho Northern has ordered two coaches and two combination smoking and baggage cars from the American Car & Foundry Co.

The Wabash directors, it is understood, have authorized the buying of about 2,000 freight cars. The order will probably be given to the American Car & Foundry Co.

The Omaha Packing Co. is figuring on ordering some refrigerator cars, as noted Feb. 9. We are officially informed that these cars will be ordered soon, and understand that 200 will be ordered now and later increased to 400.

The American Car & Foundry Co. has received an order from a contractor for three coaches and five excursion cars for a railroad in Mexico. The car company reports that its passenger car departments are full of work and that it is figuring on some new orders.

The Northern Pacific is building, at its South Tacoma shops, 350 flat cars, 41 ft. long and of 70,000 lbs. capacity, and is reinforcing at Tacoma and Brainerd some 1,500 gondola cars, changing them from 40,000 lbs. to 50,000 lbs. capacity. The road is also building 500 box cars of 70,000 lbs. capacity.

The Ohio Southern is reported to have ordered 200 coal cars from the American Car & Foundry Co. It is further stated that these will be built at Indianapolis. We have no official information. Heretofore repair work only has been done at the Indianapolis shops of the American Car & Foundry Co.

The Baltimore & Ohio, according to newspaper statements, is to order several thousand wooden and steel cars. The directors of the road were holding a meeting in New York City at time of going to press, and we learn that they were then considering the advisability of ordering from 2,000 to 4,000 wooden cars. We have no information as to the proposed order for steel cars. No prices have yet been asked.

The Colorado & Southern order for cars placed with the American Car & Foundry Co. and referred to Jan. 26, was signed Feb. 7 and calls for 200 coal cars of 60,000 lbs. capacity and 50 narrow-gage stock cars of 50,000 lbs. capacity, for April delivery. The coal cars will weigh 26,000 lbs. and measure 34 ft. long and 8 ft. 8 in. wide; the stock cars will weigh 22,000 lbs. and measure 30 ft. long and 7 ft. 7 in. wide. All the cars will be equipped with American trucks and bolsters, Congdon brake shoes, Westinghouse air brakes, Fulton brasses, Smith couplers, American draft rigging, and malleable iron journal boxes with Davis lids. The stock cars will have National door fastenings and double board roofs.

BRIDGE BUILDING.

ALLENTOWN, PA.—A bridge is proposed over the Lehigh from Hamilton St. The Central of N. J. and the Traction Co. will each pay part of the cost.

AKRON, IA.—The Commissioners of Plymouth County, Ia., are negotiating with Union County, S. D., to have an iron or steel bridge built at Akron across the Big Sioux River. No agreement has been made between the counties.

BEDFORD, PA.—Viewers have been appointed to consider a bridge over Brush Creek.

BLOOMSBURG, PA.—Two bridges are wanted on an electric railroad in which B. F. Myers of Harrisburg is interested.

BROCKTON, MASS.—The New Bedford, Middleboro & Brockton St. Ry., according to report, proposes to build a bridge at Everett St.

BUFFALO BLUFFS, FLA.—A bridge will be built over the St. John's River by Putnam County. Joseph Price, County Clerk, Pulatka.

CHARLES CITY, IA.—The bridge proposed over the Cedar River will be paid for by Floyd County. The plans have not been made.

CHICAGO, ILL.—Bids are wanted March 28 for a Scherzer rolling lift bridge over the main drainage canal for the P. C. C. & St. L., the Chicago Terminal Transfer and the Union Stock Yards Co. It will be of eight tracks.

The City Engineer will soon ask for plans and bids for the bridge to be built over the Calumet River at 95th St.

CLEVELAND, O.—Bids are wanted Feb. 28 by the Board of Park Commissioners for a bridge over Doan Brook in Rockefeller Park, also for a bridge over the same stream, but in Gordon Park.

COLUMBUS, GA.—Local reports state that Mitchel's bridge and Henly's bridge, over Mulberry Creek, Harris County, are gone as well, as the Douglas Creek bridge over the Ten Mile Creek and the Clapp's Creek bridge, in Muscogee County.

DELAWARE, O.—A bill is before the legislature to authorize a $31,000 bridge over the Olentangy River at William St.

DENVER, COLO.—The county commissioners have been petitioned for bridges over Kiowa and Lost creeks east of Bennett.

DERRY, N. H.—The freshet of last week carried away three bridges in the town of Derry.

DULUTH, MINN.—The Garfield Ave. viaduct will be 1,800 ft. long and cost about $180,000. It will be 54 ft. wide with two sidewalks and will accommodate a double-track street car line. The plans call for a steel plate girder bridge and bids will probably be wanted by the St. Paul & Duluth RR., in April. The Northern Pacific, the St. Paul, Minneapolis & Omaha Ry., and the Duluth Transfer Ry., are also interested.

ENFIELD, CONN.—Two spans of the old highway bridge over the Connecticut at Enfield collapsed in the flood of Feb. 15.

FITZROY, ONT.—A new iron bridge will be built next spring between the townships of Fitzroy and Huntley. Councillor Mohr, of this place, has the matter in hand.

FONTHILL, ONT.—Chas. O. Clark asks bids to March 1 for a bridge across a stream near Chas. Summer's on the Beaverdam stone road. Plans at clerk's office.

GREAT FALLS. MONT.—The Great Northern Railroad has under consideration a bridge at a point opposite Central Ave. It will be a double structure and will carry beside the track of the railroad the tracks of the street car company.

HAMILTON, ONT.—Alderman Findlay has reported that the Dominion Governmet has consented to build a new bridge over the Grand Trunk track at the high level road.

HARRISBURG, PA.—An ordinance authorizing Councils and the city officials to enter into a contract with the railroad companies for a sub-way beneath the tracks of the Pennsylvania and Philadelphia & Reading railroad tracks and for building and maintenance of a draw-bridge across the Pennsylvania Canal by the Pennsylvania Canal Company, was introduced in the Council Feb. 12.

HULL, QUE.—The City Engineer has recommended repairs to the Gatineau Point bridge.

LINDSAY, ONT.—Victoria County Council has appointed a committee to report on a project for a bridge on the boundary line between Ops and Fenelon. The council will ask the Provincial Government to grant aid toward a new bridge to replace the East Cross Creek bridge.

MONTGOMERY, ALA.—Reports from this place state that the Tallahassee & Montgomery Railroad bridge, across the Alabama River, was washed away Feb. 13.

NAPANEE, ONT.—The county council has instructed the Road and Bridge Committee to ascertain the cost of rebuilding Mink's bridge; also to consider the repairing of the bridge across outlet from Cedar Lake.

NEWARK, N. J.—The Lackawanna has preliminary plans for the bridges needed at street crossings in connection with the track elevation plans. A new bridge must be built over the Passaic River.

NEW HAVEN, CONN.—A new bridge is proposed in place of the present Barnesville bridge.

NEW YORK, N. Y.—The bridge which is planned to cross Newtown Creek at Grand St., between Brooklyn and Queens boroughs, will be 16½ ft. clear, and will have a steel draw with a channel entry of 91 ft. on one side and 55 ft. of space on the other side, which will probably be made into a channel also. The bridge will be 36 ft. wide, with a roadway and two footpaths. The sum of $200,000 has been provided for this work, and the Bridge Commissioner expects to advertise soon for proposals.

A bill authorizing the New York Connecting Railroad Co. to build its bridge across the East River upon the line of its railroad to be used for railroad purposes only at or near Hell Gate was introduced in the New York Senate Feb. 19.

OAKLAND, CAL.—Five bids were submitted for the double drawspan bridge across the tidal canal at Fruitvale Ave. The bids were as follows: Bentley Construction Co., S. F., $57,500; H. Krusi, S. F., $56,883; Darby Laydon, S. F., $53,759; Thomas Thomson, S. F. (a), $54,900; (b), $60,000. Dundon Bridge & Construction Co., S. F., $74,884.

OTTAWA, ONT.—The Roads and Bridge Committee of the County Council have recommended that tenders be invited for a bridge over the Castor River. This committee will examine the bridge over the Carp River and report as to the necessity of a new structure.

The City Engineer states that a new bridge is needed over Patterson's Creek at Elgin St. Pooley's bridge should also be widened.

PETERBORO, ONT.—The contract for the Chemong Lake bridge for which bids were receiver Jan. 23, has not yet been let. Geo. Stewart, County Clerk.

PHILADELPHIA, PA.—Councils' Survey Committee on Feb. 13 apportioned $750,000 for 13 bridges as follows:

Thirty-first St., over P. & R.	$100,000
Walnut Lane, over Wissahickon Ave.	135,000
Fifty-seventh St., over West Chester & Philadelphia	25,000
Frankford Ave., over Frankford Creek	70,000
Sedgley Ave., at Sixth St.	40,000
Allegheny Ave., under North Penn R. R.	40,000
Wyoming Ave., over Frankford Creek	125,000
Rising Sun Lane, under North Penn R. R.	91,000
Fifty-second St., over West Chester & Phila.	25,000
Gibson Ave., over Baltimore & Ohio, city's share one-half	25,000
Seventy-first St., over Philadelphia, Wilmington & Baltimore	10,000
Armat St., under P. & R.	31,000
Passyunk Ave., over the Schuylkill River	33,000

Among the bills introduced in the Councils on the 15th, was one to appropriate $10,000 to build a bridge on the line of Coulter St. over the Philadelphia & Reading.

The Pennsylvania RR., according to report, will elevate the tracks of the Kensington branch on Trenton Ave.

The Philadelphia & Reading has let a contract to the Phoenix Bridge Co. for a steel bridge for the North Pennsylvania branch to cross the Richmond branch at Fairhill Junction. Ryan & Kelly will build the substructure.

PUEBLO, COLO.—A viaduct will be built on South Main St. for which $10,000 has been appropriated.

QUEBEC, QUE.—The Quebec & Lake Huron Ry. will need about 12 steel bridges. The largest will be over the St. Maurice and Ottawa rivers. The St. Maurice bridge, including trestle approach, will be 900 ft. long, the main span will be 350 ft. The bridge over the Ottawa will be 600 ft. long, with 300 ft. of water way. All other bridges will vary in length from 100 ft. to 250 ft. I. C. Langelier is interested. (See RR. Construction column.)

RANKIN, PA.—A bill to authorize the Union Railroad Co. to build a bridge across the Monongahela River in Alleghany County, Pa., between Mifflin Township and the borough of Rankin, has been passed by Congress. It is reported that the Carnegie Steel Co., Ltd., has awarded the contract for the bridge to the Drake & Stratton Co. and the Keystone Bridge Co., at a cost of $500,000.

SCHENECTADY, N. Y.—In regard to the lift bridge over the Erie Canal at Washington St. mentioned here last week, we are informed that at present there is a permanent bridge over the canal, approached by a steep grade from either side. The legislature will be asked to authorize the building of a lift bridge at this point and in that way get rid of the steep approaches to the present bridge. No plans have been made.

SELIN'S GROVE, PA.—The A. & P. Roberts Co. inform us that they have not received a contract for a bridge over the Susquehanna River at Selin's Grove, as stated last week.

SOUTH ZORRA, P. O., ONT.—Tenders will be received by James Anderson, Clerk, East Zorra, South Zorra, P. O., up to March 3, for a steel highway bridge in the township of East Zorra.

SYRACUSE, N. Y.—A steel girder bridge is proposed on Dickerson St. to replace a wooden structure. No appropriation has been made.

TEKAMAH, NEB.—Bids are wanted until March 6 for bridges to be built in Burt County during 1900. W. A. Moyer, County Clerk.

THOMASTON, GA.—Several bridges were destroyed by swollen stream last week.

WASHINGTON, D. C.—The report of the Chief of Engineers, U. S. A., to the District of Columbia Committee of the Senate on the Baltimore & Potomac Railroad bill as to its relations to bridges across the Potomac River, states that new railroad bridges for vehicles and foot passengers as proposed, would be detrimental to navigation and objectionable from every point of view. The bridges should be separated not less than 1,000 or 1,200 ft., which would require a marked deviation from the present line of traffic. One bridge for railroad and vehicle traffic comtined should be constructed. Colonel Allen proposes that the Secretary of War be authorized to remove the Long Bridge and build in its place a railroad and passenger bridge to contain not more than four tracks, the expense to be shared equally by the United States and the railroad company.

WINNIPEG, MAN.—The Canadian Pacific is preparing to rebuild several old bridges.

YARMOUTH, N. S.—The class of bridges to be built by the Nova Scotia Development Co., for the Halifax & Yarmouth Ry., has not been determined upon. The bridges are to cross the Clyde, Barrington and Downey's rivers. They will be about 150 ft., 100 ft. and 80 ft. respectively.

Other Structures.

BANGOR, ME.—The Main Central, we are informed, does not intend to build either a freight or a passenger station at Bangor this year.

BOSTON, MASS.—The United States Steel Co. has secured 3,000,000 sq. ft. of land partly on the Saugus Branch RR. and the Malden River, near Everett, upon which the company is about to build. The plans for the first foundry are in the hands of the E. G. Spilsbury Engineering Co. of New York. Work is to begin on the foundations about March 1. The building will be 120 x 200 ft., steel construction, and will employ about 250 men. An electrical power plant will also be built to supply power to the plant, as well as for other manufacturers. A dock to receive coal, sand and lumber will also be built. The Boston & Maine will build a spur track to the plant. Charles S. Miller is Secretary.

CHICAGO, ILL.—Plans are being prepared by the city for 115 ft. of new dock along the Chicago River just east of the Rush St. bridge. The dock is needed to strengthen the south approach to the bridge. The work will cost about $2,500 and will be done as soon as possible, 40-ft. poles being used with filling 30 ft. deep.

CLEVELAND, O.—The Empire Rolling Mills Co., recently incorporated by U. S. Walker, Louis D. Round and others of Newburg, will build a plant in the south end. James Paton, formerly of the Cleveland Rolling Mills, is also interested.

DECATUR, ALA.—It is reported that a New York company has bought the old rolling mills at this place, where it is proposed to build a bridge plant.

DICKINSON, TEX.—The Galveston, Houston & Henderson depot recently destroyed by fire will soon be rebuilt.

FACKLER, ALA.—The Southern Ry. is building a new depot here.

FRANKLIN, PA.—The Cambria Steel Co. is ready to make the contemplated improvements, which will cost about $3,000,000. Principal among the improvements will be the construction of a number of open-hearth furnaces in Franklin, work on which has already been begun, and a number of blast furnaces which will probably be built near the site of the present furnaces. Important improvements on the line of a universal mill, new coke ovens, extension of the rolling system of the company, are also contemplated.

GRAND RAPIDS, MICH.—The Pere Marquette will build car shops, on which work will be begun in the summer.

HARRISBURG, PA.—The Harrisburg Mfg. & Boiler Co. has plans under way for an extension to the plant.

JOLIET, ILL.—It is reported that the Chicago & Alton will soon build a new passenger station.

LITTLE ROCK, ARK.—The new passenger station of the Choctaw, Oklahoma & Gulf, at Second and McLean Sts., Little Rock, will cost about $42,000. The building proper will be 56 x 159 ft. or 86 x 189 ft. including the platforms.

McKEESPORT, PA.—The National Tube Co. contemplates building a plant at Christy Park, near McKeesport, to make seamless tubing of special quality. The construction contract will soon be let. The machinery, it is said, has been contracted for.

MIDDLEBOROUGH, TENN.—The Virginia Iron, Coal & Coke Co. will build an additional steel plant at this place.

MINNEAPOLIS, MINN.—The new freight terminal of the "Soo Line" will be a brick building 610 x 50 ft. and will cost about $50,000. It is undecided if the roof will be wood or steel.

Nothing has been decided in regard to the new passenger station proposed by the "Soo Line" for Minneapolis.

NICETOWN, PA.—The Midvale Steel Co. does not contemplate building a storage warehouse on the line of the Philadelphia & Reading at Nicetown, as reported.

READING, PA.—The plans for the new Philadelphia & Reading car shops are at the office of Doyle & Dook, 1509 Sansom St., Philadelphia. Bids are asked until Feb. 26. The building in general dimensions will be about 200 x 749 ft. The work will cost between $800,000 and $1,000,000. The company will do the grading.

ROANOKE, VA.—The Norfolk & Western has given a contract to J. J. Garry for the removal of the big machine shop building at Shenandoah to Roanoke. The building is 72 x 139 ft. It will be rebuilt in the inclosure adjacent to the Roanoke shop, and will be used as a frog and switch shop.

SAN FRANCISCO, CAL.—The Penn Bridge Co. of Beaver Falls, Pa., was the lowest bidder, at $29,737, for the construction of a machine shop building at the Mare Island Navy Yard, Cal.

SALT LAKE CITY, UTAH.—The new union passenger station will extend across Third South St., and into each block on either side, with a grand entrance in the center of that street, facing east, and near Fourth West St., closing Third South St. to traffic. Profiles have been filed with the City Council.

SAULT STE. MARIE, ONT.—The Duluth, South Shore & Atlantic will build a new passenger station at Sault Ste. Marie, to cost $33,000, and a freight station to cost $5,000.

TACOMA, WASH.—Several warehouses will be built here by the Northern Pacific.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xii.)

Franklin Institute.

"Some Mechanical Conceptions of Electricity and Magnetism," by Prof. W. S. Franklin, Bethlehem, Pa., President of the Electrical Section, will be the subject for the meeting Feb. 27.

American Society of Civil Engineers.

At the meeting held on Wednesday of this week, a paper by Charles S. Gowen, M. Am. Soc. C. E., entitled "The Foundations of the New Croton Dam," was presented and illustrated with lantern slides. This paper was printed in the Proceedings for January, 1900.

Pacific Coast Railway Club.

At a meeting of the club held on Feb. 17, at the Palace Hotel, San Francisco, a paper on "The Steam Engine Indicator in Locomotive Practice" was presented by Mr. H. Stillman, Engineer of Tests, Southern Pacific Co.

The address of the Secretary of the Club has been changed from West Oakland, Cal., to Sacramento, Cal., care Southern Pacific Co.

American Railway Engineering and Maintenance of Way Association.

Mr. L. C. Fritch, Secretary of the American Railway Engineering and Maintenance of Way Association, announces that the Association has established permanent headquarters at Room 1100, Monon Building, Chicago, and all correspondence relating to the Association should be sent to that address. We are also informed that railroad supply companies will be free to make such exhibits of their appliances at the Convention, March 14 to 16, as they may see fit, but that the Association will have no official participation in such exhibits, and no exhibit can be made in the rooms of the Association. The entertainment sometimes provided by exhibitors is to be excluded entirely.

American Street Railway Association.

The Executive Committee met in Kansas City Feb. 5-6, accepted the buildings offered for meetings and exhibits, and set the date for the next convention for Oct. 16-19. In addition to deciding upon Kansas City as the next meeting place and fixing the time of the convention, the Committee received the report of the Secretary and Treasurer, which showed better financial conditions than at any previous time; and selected subjects and appointed committees to prepare papers. The convention building is conveniently located, is new and large and seats 25,000 people. It is 314 ft. long by 198 ft. wide and has modern heating and lighting arrangements.

The New York Railroad Club.

A meeting of the Club, of more than usual interest, was held in the rooms of the Metropolitan Street Railway Association, 50th St. and Seventh Ave., on Thursday evening of last week. The announcement that it would be an "electrical evening" and that Prof. Durand, Mr. Potter, Mr. Starrett and others would speak brought together 325 or more members and their friends. Before the meeting was called to order, the members had an opportunity to examine the machinery and electrical apparatus in the meeting room and incidentally to become in a way familiar with the workings of that worthy institution, the Metropolitan Street Railway Association of New York. President Vreeland presided. In the unavoidable absence of Prof. Durand, Prof. R. B. Williamson of the International Correspondence School, Scranton, Pa., opened the discussion by talk on "the A B C of electricity." The important work of Faraday early in the century was spoken of, and this was followed by an explanation of why an electric motor revolves. The principles on which continuous and alternating current dynamos are built was taken up with some care and a simple explanation was given of the main differences between the two types of machines. Mr. Williamson was followed by Mr. W. B. Potter, Chief Engineer of the Railway Department of the General Electric Co. He discussed the generation and transmission of electricity, with particular reference to three-phase transmission, which is being so widely adopted in recent important installations. Mr. Potter referred to the advantages of collector rings over commutators and followed with a discussion of the best kinds of machines for high-tension transmission, with special reference to the stationary armature type. Such machines have been built for currents as high as 12,000 volts. Mr. M. G. Starrett, Chief Engineer of the Metropolitan Street Railway Co., then told of the development of the conduit electric roads in New York. Many views were thrown on the screen showing the Ninety-sixth Street power station in several stages of construction. The main features of this station have been illustrated and described in the Railroad Gazette, the most recent reference being in our issue of Jan. 12 last, page 20. It may be here noted that the chimney of this power station is 360 ft. high and 55 ft. square at the base. It is laid on 1,300 40-ft. piles driven 19 ft. below high water level. The following are the estimated losses in the generation and transmission of the current at the Ninety-sixth Street power station: General loss in station machinery, five per cent.; loss in high-tension transmission, four per cent.; loss in substations, static and rotary transformers, seven per cent.; losses from substation to cars, five per cent. The total efficiency of generation and transmission is therefore 80 per cent.

Mr. R. L. Russell, Assistant Engineer Brooklyn Heights Railroad, followed with a discussion of some of the engineering problems of suburban traffic on the Brooklyn electric elevated and surface roads. In 1891 the first road was operated by electricity and the maximum capacity required on this road is now over 50,000 amperes. During the strike of 1895 the ampere output fell from 18,000 to less than 3,000 and during the strike of 1899 it fell from 38,000 to less than 22,000. To indicate what electric operation could do in building up heavy traffic, it was stated that on the Sea Beach Railroad 105,000 pasengers a day were carried during last summer, whereas with steam working the same road carried less than one-half that number. The time by steam was 15 minutes and by electricity is 20 minutes. Some of the interesting problems which had to be met and solved on the "excursion" lines of this road are given elsewhere in this issue. After adjournment a collation was served. At the next meeting of the Club (at 12 West 31st St.) Mr. W. L. Derr, Superintendent of the Elmira Division, Erie Railroad, will speak on "Water Supplies for Steam Railroads."

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. C. A. Parker has been elected Commissioner of the St. Louis Traffic Bureau, succeeding Mr. A. J. Vanlandingham, deceased.

—Mr. Geo. Simpson, who recently resigned as Assistant Civil Engineer of the Northern Pacific, has been appointed Chief Engineer of Public Works of Manitoba.

—Mr. Henry C. Robinson, a well-known lawyer of Hartford, Conn., died Wednesday Feb. 14. He was graduated from Yale University in 1853 and was elected Mayor of Hartford in 1872. Mr. Robinson had been a Director of the New York, New Haven & Hartford for several years.

—Mr. Orrin L. Jenks died at Port Huron, Mich., Feb. 5, aged 58 years. He was born in Birmingham, Mich. In 1862 his father and he established the Phoenix Iron Works. A few years ago the Jenks Shipbuilding Company was organized, with Mr. Jenks as Vice-President and Treasurer.

—Mr. Frank Ferris, General Freight Agent of the Lake Michigan & Lake Superior Transportation Company, has resigned. He was born in 1853 at Peekskill, N. Y., and is a graduate of Williams College. Mr. Ferris was at one time connected with the Cleveland, Cincinnati, Chicago & St. Louis as General Agent.

—The new Superintendent of the Central Pennsylvania & Western, Mr. M. A. Berger, was born Dec. 9, 1865. He entered railroad service as an operator of the Philadelphia & Reading in December, 1883, continuing with the company until October, 1889, when he went to Watsontown, Pa., with the Western Union and the Adams Express. After continuing there for a year, he spent another year with the Pardee Car & Machine Works, and then in October, 1892, accepted a position as operator with the Central Pennsylvania & Western. He was appointed chief clerk of the road in 1895, which position he held until Jan. 1 last, when he was advanced to his present position.

—Mr. Edwin N. Lewis died sudenly in Chicago on Friday night, Feb. 16. Mr. Lewis was well known to railroad men and supply men all over the United States. For years he had been a constant attendant at the conventions and had traveled a great deal and he had a gift of kindly feeling and of genialty which always made him a welcome visitor or companion. Mr. Lewis had been for a long time Manager of the Railway Master Mechanic, also of the Official Railway List. Probably many of his friends and acquaintances will be surprised to learn that he was 63 years old. He was born in Hamilton County, N. Y. He graduated at Beloit College in the class of 1859. He afterward went to Ottawa, Ill., and there entered a law office and eventually became a member of the law firm of Eldridge & Cook. In 1881 he went to Chicago and from that time until his death his work has been identified with railroad journals and particularly with the Railway Master Mechanic.

—Notice has been made in these columns of the appointment of Mr. A. R. Whaley as Superintendent of the Worcester Division of the New York, New Haven & Hartford, to succeed Mr. C. C. Burnett, deceased. Mr. Whaley was born Dec. 30, 1861. He entered railroad service with the Providence & Worcester on Jan. 28, 1877, as a passenger brakeman, and continued with the company as a trainman for 13 years. In June, 1890, he was appointed Assistant Trainmaster of the New York, Providence & Boston. When the road came under the control of the New York, New Haven & Hartford in July, 1892, he was made Trainmaster at Providence, R. I. A year later, following the lease of the Old Colony Road, he was made Stationmaster at Providence in charge of all trains of the Worcester and Stonington divisions. On April 22 a year ago he was made General Agent at Providence, and on Feb. 1 last was advanced to his present position. During the past 10 years Mr. Whaley has made a special study of freight work in all its branches.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—James Dun has been appointed Consulting Engineer of the entire system, with headquarters at Chicago, Ill. W. B. Storey, Jr., succeeds Mr. Dun as Chief Engineer at Topeka, Kan. The exact date on which these appointments become effective has not been definitely settled.

Baltimore & Ohio Southwestern.—W. Archer, heretofore Division Engineer, has been appointed Principal Assistant Engineer. J. G. Bloom succeeds Mr. Archer at Chillicothe, O.

Chicago & Northwestern.—Frank P. Eyman has been made Assistant General Freight Agent at Chicago.

Chicago, St. Paul, Minneapolis & Omaha.—A. W. Trenholm, heretofore Division Superintendent at Omaha, Neb., has been appointed General Superintendent at St. Paul, Minn., succeeding J. C. Stuart, resigned.

S. G. Strickland, heretofore Superintendent of the Nebraska Division, succeeds Mr. Trenholm at Omaha, Neb. Effective Feb. 15.

Delaware, Lackawanna & Western.—E. R. Holden, Vice-President, has resigned.

Denver & Southwestern.—At a meeting of the stockholders the following officers were elected: President and General Manager, W. K. Gillett of New York; Vice-President, Benjamin P. Cheney of Boston; Secretary and Treasurer, John P. Cobb of New York. The Directors are: C. F. Ayer and Montgomery Robbins of Boston; R. E. F. Flinch and A. Kessler of New York; E. W. Rollins of Denver; Godfrey Duscomb of New Haven; A. Jarvis of Toronto and K. K. McLaren of Jersey City. (See RR. News column.)

Erie & Central New York.—L. N. Frederick has been elected Vice-President.

Fort Worth & Rio Grande.—Henry C. Wicker, recently elected President (p. 95) will also assume the duties of General Superintendent.

Great Falls & Old Dominion.—The officers of this company referred to in the Construction column are: President, Jos. S. Miller, Washington, D. C.; Vice-President, R. D. Weaver; Treasurer, A. B. Grunwell; Secretary, A. B. Hines; Chief Engineer, H. A. Pressey.

Gulf, Beaumont & Kansas City.—W. C. Averill, General Passenger Agent at Beaumont, Tex., has resigned. The duties of that office will be assumed by the General Freight Agent, G. R. Wansbrough.

Kansas City, Perry & Port Arthur.—The officers of this company recently referred to in the Construction column (Feb. 2, p. 80), are: President, F. G. Moore; Vice-President, W. W. Fauls; Treasurer, Ethan Allen; Secretary, Sam. B. Wadsworth; Chief Engineer, A. J. Robinson; Attorney, Thos. H. Doyle. The Secretary's address is Perry, Okla.

Omaha & Council Bluffs Railway & Bridge Co.—At a meeting of the Directors the position of General Manager was created for W. S. Dimmock. The position of General Superintendent held by Mr. Dimmock for the past six years is left vacant for the present.

Pennsylvania.—I. B. Thomas has been appointed Assistant Master Mechanic, with headquarters at Renovo, Pa., succeeding J. C. Mengel.

Pere Marquette.—Russell Wallace, Purchasing Agent Grand Rapids Division at Grand Rapids, Mich., has resigned. Effective March 1. Mr. Wallace will, on that date, associate himself with Crerar, Adams & Co., of Chicago.

Pittsburgh, Allegheny & McKee's Rocks.—B. Robertson, General Superintendent at Pittsburgh, Pa., has resigned.

St. Louis & North Arkansas (Eureka Springs).—Geo. West has been elected Manager and Auditor. Effective Feb. 7.

Salt Lake & Los Angeles.—W. J. Bateman has been appointed General Manager, W. McMillan Secretary and Treasurer, succeeding N. W. Clayton and I. A. Clayton, respectively.

Union Pacific.—E. Stenger, heretofore Resident Engineer at North Platte, Neb., has been appointed Division Engineer at Denver, Colo., succeeding W. Ashton, resigned.

Wabash.—E. K. Woodward has been appointed Engineer, Maintenance of Way of the Detroit Division, and in adition to his other duties will have charge of matters pertaining to track and roadway. A. B. Adams, General Road Master, will be relieved of this work.

Wisconsin Central.—The headquarters of Division Superintendent F. H. Marsh have been ordered removed from Waukesha, Wis., to Fond du Lac, Wis.

RAILROAD CONSTRUCTION.
New Incorporations, Surveys, Etc.

AKRON, STERLING & NORTHERN.—This company was incorporated in Colorado Feb. 14, with a capital stock of $500,000, by G. W. Holdredge of Omaha, Neb., General Manager of the Burlington & Missouri River in Nebraska, and others, to build a railroad from Akron, Colo., north through Sterling, two towns on the Chicago, Burlington & Quincy lines.

ALABAMA ROADS.—The Cherokee Mining & Manufacturing Co. of Chattanooga, Tenn., which recently completed a line to Colyarton, proposes to build an extension of four miles to reach ore deposits.

ATCHISON, TOPEKA & SANTA FE.—Building is to be begun at once, according to report, on this line from Kingfisher, O. T., southeast 25 miles up the Cottonwood Valley to Guthrie. It is to be built jointly with the Chicago, Rock Island & Pacific. (Nov. 24, 1899, p. 819.)

An officer writes that some surveys have been made for grade reductions near Springer, N. M., and at several other points, but the estimates are not sufficiently advanced to warrant a decision as to whether the work will be done. (Feb. 9, p. 95.)

BALTIMORE & LEHIGH.—The stockholders have adopted the resolution of the directors to broad gage the entire line. (Feb. 9, p. 95.)

BALTIMORE & OHIO.—Preliminary surveys are reported in progress for a branch of the Sharpsville line from a point near Oakland, Pa., to connect with a steel plant south of Sharon.

BENWOOD & WHEELING.—This company, recently incorporated in West Virginia (Feb. 9, p. 95), is to build a line from Benwood north to Wheeling, to be used in connection with the Riverside Iron Works belonging to the National Tube Co. F. J. Hearne of Wheeling is General Manager.

BRITISH COLUMBIA ROADS.—Press reports from Vancouver state that building is begun on an all-Canadian line from Tuesnelle, B. C., on the coast, to run north through Hazleton, Telegraph Creek and Atlin, B. C., to Dawson, N. W. T. J. B. Charleson of Vancouver was to start north Feb. 22, and 70 men have begun work at Tuesnelle.

BOSTON & MAINE.—An additional track is being built, according to report, from Springfield, Vt., north eight miles to Claremont Junction, N. H.

CENTRAL & GEORGIA.—In addition to the extension from Columbia, Ala., west about 18 miles to Dothan, the company proposes to make an additional extension this year, according to report, from Dothan west about 50 miles to Hartford and paralleling the Chattahoochee River to Elkton. It is stated that all the contracts are let and the line is to be completed about July 1.

CHICAGO, ROCK ISLAND & PACIFIC.— A contract has been let and men and teams are on the ground, according to report, for building an extension from Mountain View, Okla., west about 40 miles. The road was built to Mountain View last year.

CONQUISTA COAL.—James T. Gardiner, President of the Mexican Coal & Coke Co., 21 Cortlandt St., New York, writes with reference to this line, incorporated in New York Feb. 8, that it is a line eight miles long connecting the new coal mines of the Mexican Coal & Coke Co. at Conquista, Mexico, with the Mexican International RR. at Baroteran, in the State of Coahuila. It is controlled by the Coal & Coke Co. (Feb. 16, p. 111.)

COVELLO & COLUMBIA RIVER.—This company was incorporated in Washington Feb. 13, with a capital stock of $1,000,000, to build a railroad from Covello, Columbia County, to run southwest to a point on Columbia River near Wallula, with branches to connect with lines of the Oregon Railroad & Navigation and the Washington & Columbia River. The principal office is Dayton, Wash. The Directors are: J. A. Thronson, J. A. Turner and C. J. Thronson, all of Dayton, Wash.

DULUTH & NEW ORLEANS.—Arrangements are reported completed for building the portion of this line in Iowa between Des Moines and Nevada. The company has bought 85 miles of rails and it is stated that work is to be begun at once. Lawler & Reid of New York City have the contract. The road is projected to run from Duluth, Minn., south to New Orleans, La. S. V. Wardell of Ames, Ia., is President. (Dec. 8, 1899, p. 853.)

DURANGO & EL SALTO.—This company was incorporated in Massachusetts Feb. 17, with a capital stock of $300,000, to build a railroad from Durango, State of Durango, Mexico, on the Mexican International, to run west about 80 miles to El Salto.

EAGLE PASS, FREDERICKSBURG & LLANO.—This company has been organized at San Antonio, Tex., to run from Llano, on the Austin & Northwestern line of the Southern Pacific, southwest about 200 miles to Eagle Pass.

EAST & WEST.—See Railroad News column.

EAST LOUISIANA.—The company is re-laying a portion of its line with heavier rails and making other improvements.

FLOVILLA & INDIAN SPRINGS.—The business

men of Jackson are asking for an extension of this road north about five miles to their city.

GREAT FALLS & OLD DOMINION.—The route of this proposed line is from Rosslyn, Va., via Cherrydale, Hillsdale, Lincoinville, Langley, Lewensville and Prospect Hill to the Great Falls of the Potomac, about 16 miles. Surveys are in progress and the prospects for building are favorable. The work is not difficult. There will be one small bridge. (Feb. 16, p. 111.) The officers are given under Elections and Appointments. (Official.)

ILLINOIS CENTRAL.—Surveys are reported completed for the Canton, Aberdeen & Nashville extension from Winfield, Ala., southwest 58 miles via Vernon, Ala., and Caledonia, Miss., to West Point on the I. C. The line was finished from Winfield to New River, about nine miles, last year. (Aug. 4, 1899, p. 561.)

INTERNATIONAL & GREAT NORTHERN.—An officer writes that no information has been received as to a proposed extension through Quitman, Tex. (Jan. 26, p. 64.)

JAMES RIVER.—Surveys are completed and building is to be begun soon on this line from Portsmouth, Va., northwest about 25 miles to Smithfield. John L. Watson of Portsmouth, Va., is an incorporator. The bill to incorporate this company was recently introduced into the Virginia Senate. (Feb. 9, p. 95.)

KANSAS CITY, JOPLIN & LITTLE ROCK.—The route of this proposed line is from Scammon, Kan., to run east via Galena to Joplin, Mo., and thence via Dueneweg, Sarcoxie and Stotts City to Aurora, and ultimately to Yellville in the Arkansas mineral fields. Branches will be built from Joplin to Orongo, Belleville and Granby, Mo., and to Pittsburg, Kan. The central offices and shops will be at Joplin. It is stated that the Missouri, Kansas & Texas has arranged to run trains over the new line from Parsons, Kan., to Aurora. (Jan. 19, p. 48.)

KANSAS CITY, MEXICO & ORIENT.—This company was incorporated in Kansas Feb. 17, with a capital stock of $1,000,000, to build a railroad from Kansas City southwest via Topeka and Wichita, Kan., and El Reno, Okla., and through northwestern and western Texas, between the Atchison and Rock Island lines, to a point on the Rio Grande about 200 miles southeast of El Paso, Tex., and thence southwest to Chihuahua, Mex. At that point it is to connect with the Chihuahua & Pacific, which is building west to Guerrero, and is to be completed to the Gulf of California. Among the incorporators are Arthur E. Stillwell, Kansas City, formerly President of the Kansas City, Pittsburgh & Gulf; J. W. Hirst, Omaha, Neb.; W. S. Woods and W. A. Rule, bankers of Kansas City; J. C. Fox and E. W. Snyder, Leavenworth, Kan.; Herman Kuhn, London, Eng.

MISSOURI & IOWA SOUTHERN.—A. L. Strang, President of this line, has returned to his home at Sedalia, Mo., from a visit to New York, and states that financial arrangements are completed to begin building the line within 30 days. It is projected to run from Sedalia, Mo., north 50 miles to Miami. (July 15, 1898, p. 522.)

MISSOURI, KANSAS & TEXAS.—An officer writes that there is no foundation for the report that the company will extend its line to Carbon Center, Mo. (Feb. 9, p. 96.)

MISSOURI PACIFIC.—The engineers are reported to have received orders to begin locating at once the Bagnall extension to run from Bagnall, Mo., southwest about 80 miles to Springfield. (Nov. 17, 1899, p. 800.)

MORENCI & SOUTHERN.—Streeter & Lusk of Chicago have taken a contract, according to report, for building this line from Morenci, Ariz., south about 25 miles to Guthrie. Grading is to be begun at once on seven miles; there are four tunnels, three switchbacks and several curves that are at least 42°. The line is being built by Phelps, Dodge & Co., New York, for the Detroit Copper Co. of Morenci. (Dec. 8, 1899, p. 853.)

NEW ROADS.—J. C. Medford of Tupelo, Miss., is interested in a proposed line from Decatur, Ala., to run west across the State of Mississippi to Helena, Ark.

NEW YORK CITY RAPID TRANSIT.—An account of the incorporation of the construction company, and other items of interest with referennce to rapid transit in New York City is given in this week's issue in the Technical Department.

NORFOLK & WESTERN.—Grading is to be begun in a few days, according to report, for a new route through North Durham, N. C.

NORTHERN SUSQUEHANNA.—The route of this company's line is from Bailey Run, Potter County, Pa., to run south to Sinnemahoning, Clinton County. Preliminary surveys are partially completed and the prospect of building is good. (Feb. 9, p. 96.) M. E. Olmsted of Harrisburg, Pa., is President and General Counsel. (Official.)

OFFERMAN & WESTERN.—This line, according to report, has been completed from Offerman, Ga., on the Savannah, Florida & Western, northwest 36 miles to Nicholls, and it is proposed to extend it about 30 miles further to Ocilla. C. M. Craig of Savannah, Ga., is Engineer. (July 7, 1898, p. 4.)

OKLAHOMA & SOUTHERN.—This company has been incorporated in Oklahoma, with a capital stock of $4,800,000, to build a railroad from Kiowa, Kan., to run southeast to a point in Lincoln County, Oklahoma. The estimated length is 400 miles. The central office is Cherokee, Okla. The directors are: H. A. Wagner, Omaha, Neb.; T. J. Brockway, Augusta, O. T.; A. J. Titus and J. B. Randels, Anthony, Kan.; J. O. Titus, Jefferson, O. T.

OREGON MIDLAND.—The people along the route have pledged $150,000 for this proposed line from Klamath Falls, Ore., southwest about 60 miles to a point on the Southern Pacific near the State line. George T. Baldwin of Klamath Falls is an incorporator. (Feb. 9, p. 96.)

OREGON SHORT LINE.—A contract has been closed, according to report, with the Utah Construction Co. of Ogden (successor to Corey Bros. Co.), to do all the improvement work of the company for the year 1900. These improvements, according to report, will approximate $250,000, including a line west from Pocatello, Idaho, and side tracks and spurs near Diamondville, Wyo.

PENNSYLVANIA.—Invitations have been sent out to contractors by Assistant Engineer R. T. Morrow of Pittsburgh to inspect plans and specifications for extensive improvements at Youngwood, Pa. These are to consist of about 30 additional tracks between Fosterville and Foxtown, with Youngwood as the central point.

B. B. Gonder of Strasburg, Pa., has taken the contract for grading and masonry on the two additional tracks from Coatsville to Hope's Tower, Pa. (Feb. 16, p. 112.)

Citizens of Trappe, Md., are asking for a branch of the Philadelphia, Wilmington & Baltimore from Trappe station southeast about five miles to their city. They propose to give the right of way. A committee headed by Robert Bittler has been appointed to confer with the railroad.

PORTLAND, VANCOUVER & YAKIMA.—President L. Gerlinger of Vancouver, Wash., is reported as stating that a contract has been let for a short extension of this line, and that work is begun on a big bridge across Salmon Creek. The road is projected from Vancouver, Wash., northeast 170 miles to North Yakima, and 17 miles is in operation. (Dec. 8, 1899, p. 858.)

QUEBEC & LAKE HURON.—This line is to run from Quebec west about 440 miles via Ancienne, Lorette, St. Bazille, St. Alban, St. Ubalde, St. Tite, Grandes Piles, St. Michel des Saints, Rapide de l'Original, Riviers, Joseph and Mattawa to the mouth of French River on the Georgian Bay. The large basin formed by the mouth of French River has sufficient depth of water to accommodate vessels drawing 24 ft. of water. Exploratory surveys only have been made. The intention of the promotors is to begin building as soon as they have obtained their incorporation on the 115 miles between the River Ottawa and the Georgian Bay. Building may be begun within a month after the engineers start location. The same is true of the section between Quebec and the River St. Maurice. On the section of 30 miles from St. Maurice westward, the work will be difficult in some places, but the intention is to make light grades and curves. When the Quebec bridge over the St. Lawrence is built, the line will connect with the Quebec Central and with the Boston & Maine system and thus reach Portland and Boston. It is also proposed to furnish an eastern outlet for the Canadian Northern, now being built through Minnesota and Manitoba. John M. Nicol of 311 Hammond Bldg., Detroit, is the chief promoter. (Feb. 16, p. 112.) Mr. Nicol also has quarters at 64 West Twenty-ninth St., New York. (Official.)

ST. LOUIS & SAN FRANCISCO.—Johnston Bros. & Faught of St. Elmo, Ill., who have the general contract for the extension from Sapulpa, I. T., southwest about 200 miles to the Red River in Texas, have sub-let about 40 miles of grading and track laying to McCabe & Steen and will let the rest within 30 days. (Feb. 16, p. 112.)

ST. LOUIS, IOWA & NORTHERN.—Contracts are reported let from Union, Mo., to the Gasconade River, 50 miles, for this proposed line from Union, Mo., north about 175 miles to Eldon, Ia. The St. Louis, Kansas City & Colorado is closely connected with this proposed line. C. J. DuBois of Macon, Mo., is Chief Engineer. (Dec. 29, 1899, p. 902.)

SALINE COUNTY, BAUXITE & GRANITE.—The route of this company, whose incorporation on Jan. 29 was noted Feb. 9 (p. 96), is from Bearden's Field, Ark., near the southeast corner of Section 5, Township 2, Range 14 West, to run southeast to a point in Crumby's Field of Section 16. Among the incorporators are: J. J. Beavers, J. F. Shumaker, D. E. Gann, W. L. Cooper, F. W. Bush, Benton, Ark.; G. M. McKenzie, Bryant, Ark.

SOUTHERN PACIFIC.—An officer writes that the improvements to be made on the Central Pacific are in line with the general policy of continually bettering the properties. The company expects during the coming year to do some ballasting in Nevada and Utah, where the line is not ballasted, and to lay considerable 75-lb. rails. (Dec. 8, 1899, p. 853.)

TEXAS ROADS.—M. F. Myatt of William Penn, Washington County, is promoting a railroad from William Penn to run south about 18 miles to Chappell Hill. Mr. Myatt has raised $20,000 and secured much of the right of way.

Subscriptions amounting to $35,000 have been obtained, according to report, for a new railroad from Houston, Tex., south to Surfside. The papers are being circulated at Quintana, Tex.

The State, according to report, will build a railroad to property used for a convict farm near Velasco. John W. Maxcey of Houston, Tex., is engineer in charge.

TIDEWATER & WEST VIRGINIA.—A bill has been introduced in the Virginia Senate to incorporate this company, with a capital stock of not less than $100,000, to build a railroad from some point in Rockingham, Shenandoah or Frederick counties, to run south to a poit on Chesapeake Bay between the York and Potomac rivers. The incorporators are: W. H. Hall, F. P. Woodruff, George U. Holman, George H. Pierce and George C. Cressey.

TREDEGAR MINERAL.—This line which extends from Jacksonville, Ala., to Tredegar Junction, four miles, is to be extended on this year to Iron Mountain, about six miles. J. W. Burke of Jacksonville, Ala., is President and General Manager.

UNION PACIFIC.—The Julesburg branch between Sterling and Denver, Colo., is to be re-ballasted with gravel. New ballasting is already completed between Sterling and Julesburg.

WEST VIRGINIA ROADS.—A. H. Whitsett, of Whitsett, Pa., is organizing a company to build a railroad from Kingwood, W. Va., to Hardman's Station.

The Mountain City Lumber Co. is building a railroad along Leatherwood Creek about 18 miles. James Flynn of Clay C. H., W. Va., is Manager.

WICHITA & SOUTHERN.—The Secretary of the Interior has granted permission to this company to locate its lines across Osage Reservation and the Creek and Cherokee nations in Indian Territory. The line as projected is from Wichita, Kan., south via South McAlester, I. T., to Denison, Tex. O. H. Bentley of Wichita is President. (Nov. 10, 1899, p. 788.)

GENERAL RAILROAD NEWS.

ALABAMA & VICKSBURG (Q. & C.).—A special meeting of the stockholders will be held at Jackson, Miss., March 19, to act on an increase of the capital stock.

BENNINGTON & RUTLAND.—Burlington (Vt.) press reports state that a contract was signed on Monday whereby the control of this company passes over to the Rutland RR. The B. & R. extends from Rutland, Vt., to Bennington, 57.06 miles, with a branch from North Bennington to White Creek, on the New York State line, 1.85 miles.

CARSON & COLORADO.—This line is reported sold to the Southern Pacific. It runs from Mound House, Nev., south to Keeler, Cal., and it is proposed to make an extension south from Keeler about 75 miles to Johannesburg on the Randsburg, or to some other point on the Southern Pacific. This will make a new through line to the northeast. (RR. Construction column, Dec. 1, 1899, p. 835.)

CHICAGO & NORTHWESTERN.—A formal transfer has been made of all the lines of the Dakota Central to the Winona & St. Peter, a subordinate company of the C. & N. W. The Dakota Central includes 723.92 miles in North and South Dakota, and is operated as the Dakota Division of the C. & N. W.

COSHOCTON & SOUTHERN.—Press reports state that this property which extends from Coshocton, O., to Zanesville, 29.47 miles, has been taken over by the Wheeling & Lake Erie. It has been controlled by the receiver of the Cleveland, Canton & Southern.

EAST & WEST.—After extended litigation, this property passes under the control of the estate of the late Eugene Kelly of New York. Extensions are to be made from Pell City, Ala., west about 30 miles to Birmingham, and from the east end at Cartersville, Ga., to connect with the Seaboard Air Line. (RR. Construction column, Oct. 20, p. 737.)

LEBANON SPRINGS.—The Vermont section of this road, about six miles long, is to be sold at public auction at Bennington, Vt., Feb. 28. The New York end of the line was bought in August last by W. C. Roberts of New York, and is now reorganized as the Chatham & Lebanon Springs. (Aug. 25, 1899, p. 604.)

NORFOLK, VIRGINIA BEACH & SOUTHERN.—This property, which extends from Norfolk to Virginia Beach, Va., 17.4 miles, with a branch from Kempsville to Munden Point, 22 miles, has been sold to the Norfolk & Southern. (N. & S., Jan. 19, p. 48.)

NORTHWESTERN ELEVATED (CHICAGO).—The company has recently authorized $5,000,000 first mortgage bonds, dated Jan. 1, 1900, and these were offered to stockholders of record of the Columbia Construction Co., on Feb. 15 last, at 99 per cent. and accrued interest to Feb. 21. Each stockholder has the right to subscribe to the par value of the stock owned. The notes issued under the agreement of Jan. 2, 1899, have been called for payment March 1, and these, when held by stockholders, may be presented in exchange for the new bonds. The common and preferred stock deposited as collateral for these loans will be released and distributed. Both the common and preferred stock are to be placed in a voting trust until the full 5 per cent. dividend shall have been paid for three consecutive years. The trustees are John Mitchell, Marshall Field and Jas. A. Blair.

OHIO & LITTLE KANAWHA.—This company, which was recently incorporated to take over the Zanesville & Ohio and to make extensions, has been authorized by the Ohio Secretary of State to increase its capital stock to $2,250,000, of which $1,250,000 is to be preferred, entitled to 5 per cent. dividends, non-cumulative. (Z. & O., Jan. 26, p. 64.)

PITTSBURGH, SHAWMUT & NORTHERN.—Henry Marquand & Co., New York, are offering $2,000,000 additional bonds of this company. The mortgage provides for an issue of $12,000,000 of bonds at par, and the company has authorized the issue of $6,000,000. Of this, $4,000,000 has been issued and the proceeds applied to the purchase and improvement of the properties, including the building of connecting lines and the acquisition of a large equipment. The new bonds are to be used for completing the line between the Shawmut mines and Wayland, for building necessary branches, for making betterments and buying equipment. These results are to be completed this coming summer. (Aug. 25, 1899, p. 604.)

TENNESSEE COAL, IRON & RAILROAD.—The Executive Committee, at a meeting held Feb. 9, agreed upon a plan to retire the $1,000,000 of 8 per cent. cumulative preferred stock and for the payment of the 54 per cent. of accumulated dividends. This will be submitted to the stockholders at the annual meeting March 14.

THIRD AVENUE.—A protective committee consisting of Frederick P. Olcott, Louis Fitzgerald and T. Jefferson Coolidge, Jr., have been requested by holders of a large amount of the unfunded debt of the company to act for the protection of their interests. They notify all holders to communicate with their Secretary, Alvin W. Krech, 120 Broadway. Messrs. Kuhn, Loeb & Co., have notified the directors of their withdrawal from the negotiations for the funding of the floating debt. The requirements of the company are said to aggregate $35,000,000 as follows: Loans from banks, $17,000,000; due to contractors and for supplies, $5,000,000; funds needed to complete power house, about $7,000,000; needed to change equipment on the various properties, about $6,000,000.

WESTERN MARYLAND.—The Commissioners of Finance of the city of Baltimore have authorized the sale of 3½ per cent. stock to retire the $875,000 third mortgage 6 per cent. bonds which matured Jan. 1 last. The bonds have been called for payment on March 1 by the City Register. (Feb. 9, p. 96.)

WHEELING BRIDGE & TERMINAL.—Messrs. Kuhn, Loeb & Co., New York, have obtained a majority of the first and second mortgage bonds and the stock of this company. It has been in the hands of receivers since Sept. 20, 1893.